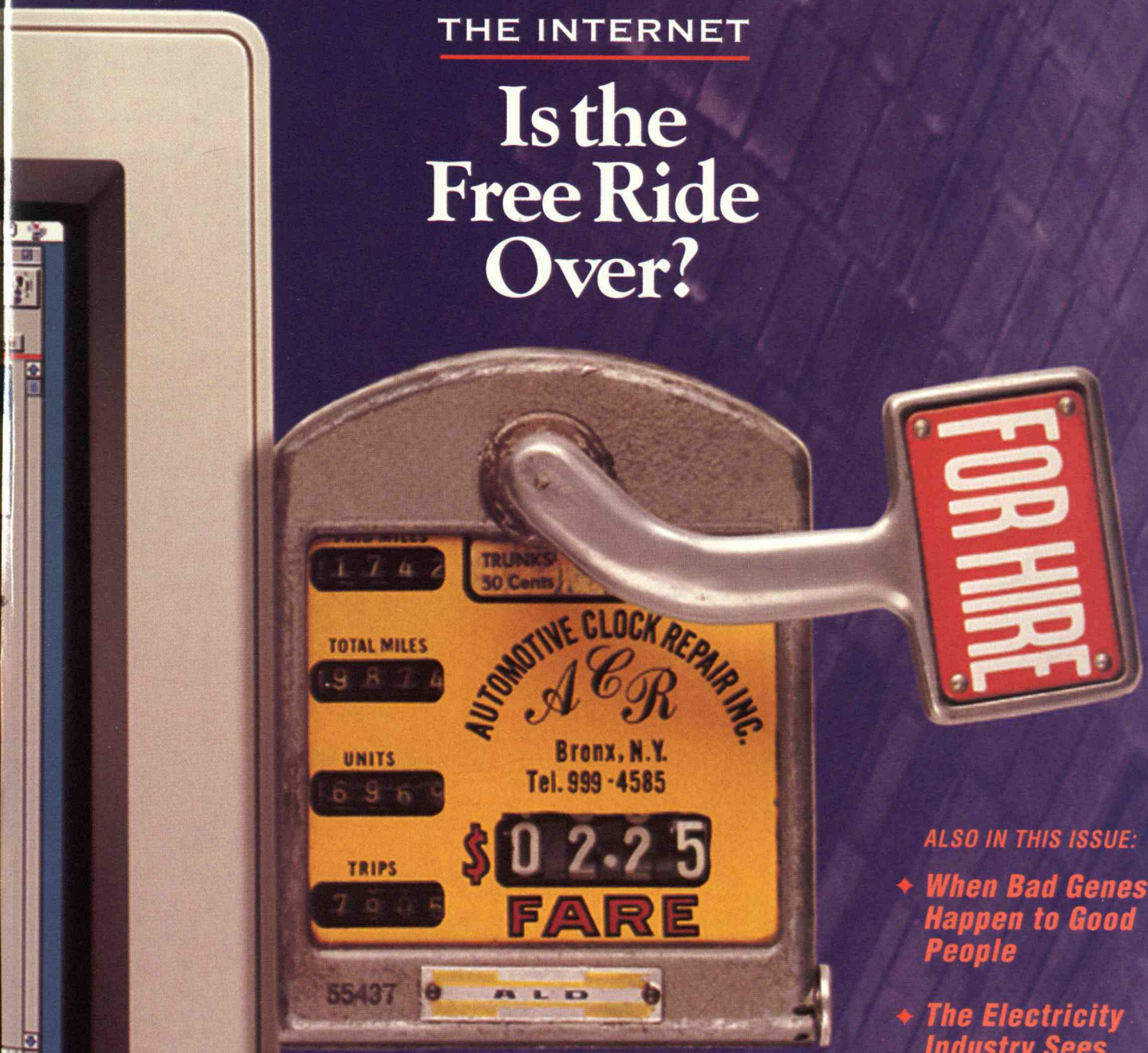
Technology Review

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THE INTERNET

Is the Free Ride Over?



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- When Bad Genes Happen to Good People
- The Electricity Industry Sees the Light
- 50 Years Later: How World War II Shaped R & D
- The Robot Who Paints

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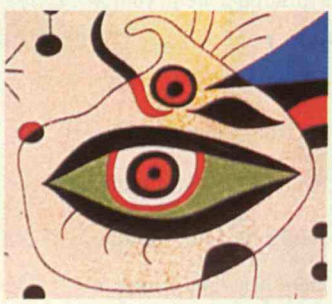
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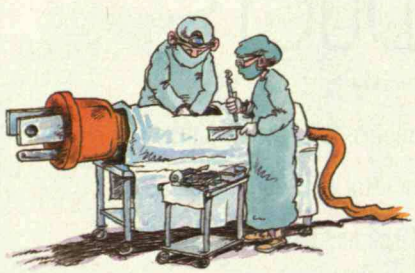


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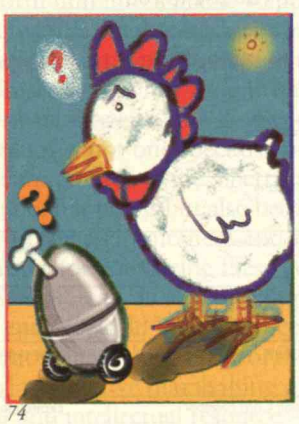
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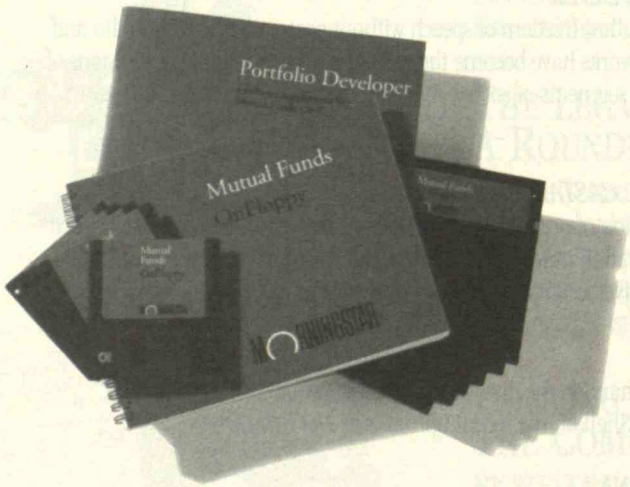
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First Line

Transforming a Superpower

SOME years ago, TV's *Saturday Night Live* presented a comedy sketch based on the following proposition: What if the infant Superman, who came to earth during the 1930s and touched down in heartland America, had instead landed in Nazi Germany? In place of the kindly superhero we all knew and loved—who had grown up to serve "truth, justice, and the American way"—viewers were presented with "Übermann," a strutting villain who used his powerful gifts only in pursuit of Hitler's misbegotten designs.

Why was this grim scenario funny? Because of its absurdity: Superman was a quintessentially American creation, a symbol of might tempered with a sense of right, a tireless and invincible doer of good deeds—in short, an embodiment of the way most Americans have traditionally regarded the United States of America. Superman as a national of any other country was unthinkable, and laughable; to transform him into a goose-stepping fascist only took the displacement to its most ridiculous extreme.

The United States has long been regarded by its citizens as a Superman among nations, not only because of its ironclad commitment to life, liberty, and the pursuit of happiness but also because of its awesome technological and economic means for converting these goals into realities. Recall, in this fiftieth year since the end of World War II, the country's extraordinary mobilization—the rapid and productive marshalling of its industrial and intellectual resources—to win that war.

How the country accomplished these feats—specifically with regard to inspiring its scientific and engineering talent to near-superheroic levels of productivity—together with the effects of these wartime achievements over the ensuing decades, are the subjects of "The Legacies of World War II: A Roundtable Discussion," in this issue. A distinguished group of scientists, engineers, and historians who know the era well (often from direct personal experience) describe some of the "magic ingredients" in the country's successful wartime efforts.

But what works in wartime is not necessarily applicable to peacetime, and can be downright harmful. Our "super power," in other words, can backfire. "The only point of government is to safeguard and foster life," observed Nobel laureate George Wald, a professor of biology at Harvard University, in a memorable speech at MIT in 1969. "Our government has become preoccupied with death, with the business of killing and being killed." The result, he asserted, is that the military establishment "is corrupting the life of the whole country [by] buying up everything in sight: industries, banks, investors, workers, universities."

Dear Uncle Sam:
The war is over.

By contrast, our former enemies Germany and Japan restructured their institutions for peacetime and a new economic era. They directed their resources and investments to civilian applications, and flourished as their growing world-class industries served global markets. One might even say that they ultimately won World War II, moving on to more meaningful campaigns while we were still rattling our swords.

Military institutions, Supermanlike imagery, and narrowly defined crash programs, of which the ultimate example has been the Manhattan Project, are of course highly appropriate for fighting wars, where there is usually a well-defined enemy whose containment we can envision if we take particular sequences of specific actions. Winning a war isn't easy—in fact, it's "hell"—but at least it's a quantifiable problem that sooner or later produces unambiguous results.

No wonder, then, that we use martial metaphors for nonmilitary problems—Lyndon Johnson's War on Poverty, Richard Nixon's war on cancer, Jimmy Carter's "moral equivalent of war"—in the wishful belief that they, too, will be quickly and thoroughly resolved. The country's space exploits, many of which were themselves a direct consequence of warlike competition with the Soviet Union, have inspired a related metaphor: "If we can get people to the Moon, why can't we [solve this or that social problem]?" But such comparisons are usually faulty because the phenomena involved are far more complex, long-term, and ill-defined.

The fundamental contradiction here may be that our institutional structures are a little too "male." That is, the model of competitiveness, battle, dominance, and well-defined movement toward singular solutions may be totally inappropriate for dealing with so many of today's social, political, economic, even technological problems. Because these situations lend themselves more to nurturing than to conquest, we need to employ the "female" model: collaboration, emphasis on process and growth, and a gentle, patient, and flexible approach to what is complicated, imprecise, and slowly changing.

Where there is no "enemy," it makes more sense to treat people as friends and colleagues, all working together to address mutual problems. "The thought that we're in competition with the Russians or with the Chinese is all a mistake, and trivial," said Professor Wald in his farsighted 1969 speech. "We are one species, with a world to win. Our business is with life, not death. Our challenge is to give what account we can of this corner of the universe that is our home—what becomes of humanity, all human beings of all nations, colors, and creeds. It has to become one world, a world for all people, the only such world that can offer us life and the chance to go on."

For the United States, at least, the basic task here may be conceptually simple after all: to switch its can-do image from Superman to Superwoman. ■

—STEVEN J. MARCUS

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Letters

COOPERATING ON NEW MATERIALS

In "Bringing New Materials to Market" (*TR February/March 1995*), Thomas Eagar suggests that cooperative ventures will help commercialize new materials in the future by enabling companies to rise above line-of-sight economic planning to recognize the big picture. Eagar refers to a partnership between AT&T and Corning to produce optical fibers as the kind of cooperation that will lead to success. Although such vertical partnerships clearly offer opportunities, they are not risk-free, especially for small competitors in an advancing field for whom the choice of the wrong partner may be fatal.

We may be able to learn how to reduce this risk from Japan. As one who has done business in that country for many years, I have been impressed with the power of the Ministry of International Trade and Industry to organize patent pools by identifying a technology of national importance, allocating seed money, and providing administrative guidance to firms in a consortium. The member firms are then free to use technology developed and commercialized cooperatively under common license.

Perhaps a similar approach could work in the United States. The National Institute of Standards and Technology could develop a consensus on the goals of materials research and target funds to specific projects. A national patent pool could then be made available to the participants. With too few examples of previous successes of this type, we will need strong leadership to overcome our inertia.

DAVID C. HILL
President
Performance Materials
AlliedSignal
Morristown, N.J.

I support Eagar's general argument with an additional observation. New materials are adopted when they offer unique properties or incrementally enhance existing products.

The former are rather rare, exciting, and influential and fall outside of the scope of Eagar's article. Examples include silicon as the staple of solid state electronics and low-temperature superconductors enabling magnetic resonance imaging. The latter are much more common and find their worth in their ability to reduce costs or increase performance.

In either case, manufacturers have to provide customers with enough enhancements to justify the additional investment. As a materials scientist, I may be fascinated, but as a consumer, I am not interested in the materials from which my purchase is made. Rather, I select a product from options based on performance, styling, and cost. As manufacturers become increasingly aware that their performance depends on differentiating their products, they may be more willing to work together in materials development to reduce the risk for each individual partner.

Eagar correctly points to the Department of Commerce's Advanced Technology Program as "evidence of a shifting emphasis toward process development." This program requires a commercialization plan—one that is oriented to manufacturing—as a major component of its award criteria. However, Eagar did not note that the development of these business plans is leading to just the joint ventures necessary to shorten the 20-year interval between materials development and commercialization.

L.H. SCHWARTZ
Director
Materials Science and
Engineering Laboratory
National Institute of Standards
and Technology
Gaithersburg, Md.

Eagar is right on target in identifying most of the problems in getting new materials to market and the need to change from a competitive environment to a cooperative one. However, in analyzing the 20-year interval it takes to bring new materials to market, he overlooks one of the main causes: the mission and policy of the company that developed the new material.

During the past 30 years, materials have been developed primarily by rela-

tively conservative companies whose main product line was firmly established. Top management defined success as the continued and growing sales of existing products, not the introduction of novel materials. Even if new products were developed, there was little incentive for marketing groups to find a place for them. Without pressure from sales, the manufacturing group was never pushed to make the product at a lower cost. Unless a company decides that its commercial success absolutely depends on the continuous introduction of new products, the 20-year cycle will not shorten. (The computer hardware industry best exemplifies the success of companies that do follow such a principle.)

Another factor Eagar mentions–difficulty in building trust among various companies–merits illustration. My company, Crucible, manufactures and sells steel bar to manufacturers of cutting tools. Those manufacturers fabricate the materials into the finished parts and sell them to end users. Although each of the three parties involved has information that is potentially useful to the other, frank and open communication is virtually nonexistent because that information is often considered proprietary. The toolmaker may want to sell an improved, more costly product that will last longer but may not be able to find a market without a cost-benefit analysis by the end user. Similarly, the materials supplier may want to sell a new or improved product but does not know which products to improve. Teamwork would enable all three companies to win.



Without instilling a company culture that explicitly supports the continuous introduction of new products and creation of vertically integrated teams, we will continue to face the unnecessarily long interval between the development of new materials and their commercialization.

WILLIAM B. EISEN
President
Crucible Research
Pittsburgh, Pa.

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To Eagar's list of hindrances to the commercialization of new materials I add the explosion in litigation in recent years. Whereas little credit is given for advances that benefit society, criticism awaits any result that is less than perfect. This has not only adversely affected the posture of approving agencies, but has forced companies to abandon many ideas that could have resulted in substantial public benefit.

The materials profession itself is also a barrier to bringing new materials to market. Materials engineers have traditionally been taught that structure determines properties. Emphasis has shifted only recently to an understanding of how processing creates or inadvertently modifies the structure from which these desired properties are obtained. The modern technological university must educate materials engineers on the critical role played by processing in creating new materials.

MICHAEL J. CIESLAK
Sandia National Laboratories
Albuquerque, N. Mex.

RECYCLING FACTS

After reading "From Villain to Hero" (*TR January 1995*), I realized that we at IMCO Recycling, Inc., where I am a director, have publicized our work poorly.

The authors, Julian Szekely and Gerardo Trapaga, state, "Today, the companies that recycle aluminum are the same as those that make aluminum from ore." IMCO does not make any primary aluminum (aluminum from ore); instead, we make secondary aluminum (recycled from scrap and dross) along with a small amount of secondary magnesium and zinc.

The authors also state, "Right now, almost all the 3.7 million tons of aluminum made annually in the United States is produced by the electrolytic decomposition of alumina, a substance found in naturally occurring bauxite ore." In 1993, the U.S. production of primary aluminum was 3.7 million metric tons. However, this was augmented by more than 2.9 million metric tons of secondary aluminum, and 1.85 million metric tons of imported primary. While 42 percent of the secondary material was supplied by the primary producers, 58 percent came from independent secondary smelters.

JACK C. PAGE
Dallas, Tex.

DETERRING COUNTERFEITERS

"Desktop Counterfeiting" (*TR February/March 1995*) is the best treatment of this threat that I have read. As McClellan notes, most of the existing and even proposed deterrence features are two-dimensional and can be easily foiled with artistic talent or easily attainable equipment. However, three-dimensional patterns can better thwart would-be counterfeiters.

To implement this concept, each document must contain a unique identifier consisting of a randomly generated three-dimensional pattern. The identifier could consist of natural features such as the pattern of paper fibers in the document, or of special materials introduced into the paper during manufacturing. When the document is printed, an imaging device would generate a numerical description of the identifier's three-dimensional properties. This description is encrypted and printed on the document in a bar code or other pattern readable by machines.



Authenticating a document would entail using a device that reads the unique identifier pattern, recognizes and decrypts the authenticator, and compares the two. A match would validate the document.

Actually, careful selection of the nature of the random pattern might permit counterfeit detection without the use of special equipment. For example, if the unique identifier consisted of a random

pattern of short optical fibers introduced into the paper during its manufacture, the fibers could be detected by sight and touch. Further inspection with a small light source such as a pen light could detect whether these fibers conduct light.

DONALD W. BAUDER
Albuquerque, N. Mex.

I read "Desktop Counterfeiting" with interest. However, I would like to point out a racial bias that lent the article a sensational feel.

In the first example of counterfeiting mentioned in the article, the author cites an international counterfeiting ring without naming the principals. In the second example, he refers to a convicted New York woman without providing her name. He then provides the full name of an Egyptian citizen who forged visas for an Egyptian terrorist leader whom he also names. The only other named counterfeiter is now a good guy advising financial institutions on how to avoid check fraud.

The only really bad guys are the two named Arabs. The article would have been just as interesting without the names of these men. American media are plagued by an anti-Arab and anti-Muslim bias. Perhaps one day we in this country will not feel the need to single out racial groups except to recognize their lofty accomplishments.

JOHN MAKHOUL
Winchester, Mass.

CREATING NEW REALITIES

I was on the fence about subscribing to your magazine until David Brittan's Phenomena column "My Mind Explores the Universe" (*TR October 1994*) pushed me over the edge!

I timidly admit my feelings of warmth and regard for the handful of eccentric letter writers Mr. Brittan cited. The observation of one such writer, "My body spends most of its time in this room, but my mind explores the universe," is so telling. Unfortunately, most of us don't admit our mental travels often enough.

Technology Review probably receives so many of these letters because science and technology redefine and reshape reality. As a result, many people feel threatened and fearful. They would benefit from a small dose of the creative skills displayed by your letter writers both in dealing with reality and in trying to create their own.

JULIE P. MACKENZIE
The MindSailing Collaborative
Minneapolis, Minn.

ALL IN THE FAMILY

I enjoyed "Science Fiction: Stepchild of Science" by Frederick Pohl (*TR October 1994*). In naming scientists who wrote science fiction, it's a pity he didn't mention Norbert Wiener. During my time at MIT in the early 1950s, Wiener was considered a genius; his various contributions included establishing the science of cybernetics. When asked why he wrote science fiction under the pseudonym W. Norbert, Wiener replied that it enabled him to keep his professional writing separate from his science fiction writing.

RICHARD C. MCCALL
Woodside, Calif.

CORRECTION:

In "Sheriffs of Scientific Correctness" *(TR February/March 1995)*, Langdon Winner wrote that the Smithsonian Institution exhibit "Science in American Life" had been "the focus of efforts by the American Chemical Society to remove displays that expressed concern for environmental damage and social justice." In fact, the ACS provided funding for the exhibit despite its earlier concerns about plans to include materials on pollution and other social issues in the exhibit. After "Science in American Life" opened, it was the American Physical Society that protested what it viewed as the exhibit's negative portrayal of science. We regret the error.

Continued on page 78

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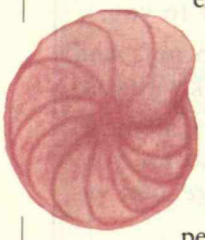
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MIT Reporter

Of Seashells, Ancient Climate, and Fossil Fuels

Before the last major glaciers had melted 10,000 years ago, and going at least as far back as 100,000 years, the climate in western Europe, already colder than it is today, used to nosedive repeatedly. Every so often average temperatures would suddenly plummet perhaps 8° to 10° F, the equivalent of switching from Texan to Canadian weather, for some 100 to 1,000 years. Then, just as abruptly, they would rise again.

These climate changes, which occurred in as little as 20 years, appear to correlate with the flow of the so-called conveyor belt, an enormous current widely believed to circulate through all the oceans, weakening and strengthening over time. Fortunately for humans and others in the modern era, the belt's flow has not diminished recently. But dozens of scientists are trying to figure out if the conveyor belt could weaken in this era, causing temperature drops in western Europe and perhaps other parts of the globe.



Their approach is to analyze the belt's behavior during the last period in which the earth was generally at least as warm as it is today—between 127,000 and 118,000 years ago—and determine whether deep-water ocean circulation patterns, and therefore climate, suddenly changed in that period.

The work entails digging into ancient land-ice and ocean sediments for clues. Enter Edward A. Boyle, a professor in the Department of Earth, Atmospheric, and Planetary Sciences at MIT. In the early 1980s, Boyle correlated cadmium levels in pinhead-sized seashells, left on the ocean's bottom by organisms called foraminiferae, with particular deep-water circulation patterns. Boyle has subsequently concluded that these patterns relate directly to the conveyor belt, and has connected its strong-flow state to low levels of cadmium and its weak-flow state to high levels. (When waters move swiftly they essentially flush cadmium out of the region.) His research could offer the "most convincing evidence" of how, in the deep sea, the conveyor belt fared during the last warm era, says Scott Lehman, an associate scientist at the Woods Hole Oceanographic Institute and an expert in marine conditions associated with climate change.



Pulling up cores of sediment from the ocean bottom for research on ancient climate conditions is messy business for scientist Edward A. Boyle, who wears plastic gloves so that he *does not contaminate the sample.*

Seashells in the Muck

Boyle, a chemical oceanographer, plans to join an international group of paleoclimatologist colleagues on the French vessel *Marion Dufresne* for 6 weeks this May and June to travel to different spots in the North Atlantic Ocean where ancient "foram"-containing sediments 118,000 or more years old are most easily located. When the ship enters a region 300 miles northeast of Bermuda, the crew will lower a 70-meter length of pipe into the bottom mud. After retrieving the sediment-filled pipe, Boyle and his team will spend some five years sifting through different vertical layers of the "core" to find the relatively few foram shells that exist in the muck (a technician working at a microscope for five hours will recover only 20 to 30 such shells from a handful of mud).

The researchers will use a technique called atomic-absorption spectrophotometry to find how much cadmium is in the shells from each time period. This commonly used method entails putting the shells in a slender graphite tube and using a high current to atomize them. Measuring how much light of a particular range of the spectrum moves through the resulting vapor will indicate the quantity absorbed by any cadmium atoms, and thus how much cadmium the shells contained.



Should Boyle's team discover relatively high cadmium levels at various core depths, that would mean today's world is not natu-

PHOTOS: CHRIS MEASURES; SCRIPPS INSTITUTION OF OCEANOGRAPHY

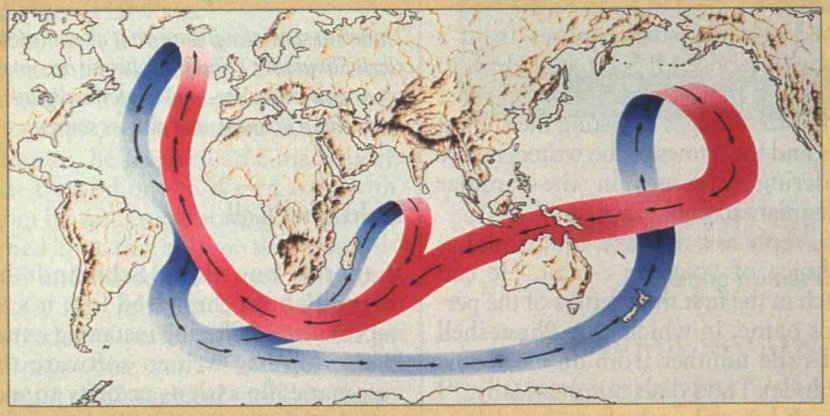


rally protected from sudden climate drops. Such a finding would also indicate how seriously the results of a climate model developed by Syukuro Manabe, a senior scientist at the National Oceanic and Atmospheric Administration's Geophysics Fluid Dynamics Laboratory at Princeton University, should be taken. According to Manabe's model—the first one coupling oceanic and atmospheric conditions in which societal carbon dioxide (CO_2) emissions have been included—continued extensive burning of fossil fuels could, in the not-so-distant future, cause the belt to slow down.

fore would not be heavy enough to sink to the bottom at a location in the North Atlantic Ocean where sinking water is said to drive the belt. With a weakened belt, less heat would travel from the tropics to western Europe, so that eventually global warming there would be moderated, with temperatures ending up perhaps 20 percent less there than elsewhere, Manabe says.

To Wallace S. Broecker, a professor of geochemistry at Columbia University's Lamont-Doherty Earth Observatory and the scientist who developed the conveyor-belt concept and first proposed that ocean-circulation patterns could drive global climate, the value of work by scientists such as Boyle and Manabe is in showing that the overall system controlling climate could change—naturally, or through unchecked human intervention—and cause significant alterations. "We should knock ourselves out to find out more," he says, since, in effect, "we're now giving the earth the best nudge we can" toward climate change.

—*LAURA VAN DAM*



Boyle's research could indicate whether the "conveyor belt" thought to circulate throughout the world's oceans could naturally weaken in the modern period, leading to temperature drops in western Europe and possibly elsewhere. Data on the belt's strength could come from analyzing pinhead-sized shells like those shown on these pages.

If atmospheric CO_2 levels double—as geochemists believe they could in about 50 years in the absence of any stabilization or reduction of fossil-fuel use—then rising temperatures could significantly augment the earth's rainfall and glacial melt. (The extra rain would come from water evaporated from the warmed ocean.) The resulting addition of freshwater runoff would presumably weaken the conveyor belt because freshwater lacks as much salt as seawater and there-

On the Phone Again

If you had come across Chris Schmandt on his most recent hiking trip in the mountains of Arizona, you might have concluded that he was out of his mind. For there, surrounded by the natural beauty of the American Southwest, you would have witnessed a person conducting business on a cellular phone while checking his alphanumeric pager for messages. Of course, it's all perfectly explainable. "I brought the phone because I was expecting some urgent e-mail," says Schmandt. "And I needed the pager because the phone's battery had only a 30-minute charge." Hmm, perhaps he'd better start at the beginning.

Schmandt is what you might call wired—or, more precisely, wireless. As director of the MIT Media Laboratory's Speech Research Group, which explores the woolly world of nomadic, or mobile, computing, he tends to live his work. And work, for the last three and a half years, has consisted of linking common technologies, such as fax machines, desktop computers, paging devices, and voice synthesizers, in new ways so users can connect to people and information whenever and wherever they want.

Many companies and academic labs are developing computer systems for people on the go—small handheld units like Apple's Newton MessagePad that can send faxes or e-mail over wireless digital networks now being fashioned out of cellular phone channels. But Schmandt is convinced that we haven't squeezed all the juice from the old technologies yet. "I want to see what we can do with existing equipment, instead of going off and building special hardware," he says. By creating and testing software that enables conventional hardware to provide an array of new communication services, Schmandt also hopes to learn which features and functions are most worthy of inclusion in future nomadic systems.

At the heart of all this is the humble telephone—partly because it is universally available and partly because it carries the rich medium of speech, which

PHOTO: JOE LEMONNIER, *NATURAL HISTORY*

mobile computers generally neglect. Each day some 15 to 20 users, mainly students and staff in the Media Lab, dial up a workstation in the lab from any Touch-Tone phone. A set of homegrown computer programs known as Phoneshell then lets the callers use push buttons to engage in more forms of electronic communication than you can shake a stick at.

To wit: When Schmandt dials into Phoneshell, a synthesized voice that sounds remarkably like the astronomer Stephen Hawking greets him by his nickname, Geek. The voice then inquires whether he would like to hear the latest hourly news from NPR or ABC, which the computer has recorded from the airwaves. (It has also downloaded weather updates from the National Oceanic and Atmospheric Administration and obtained selected stock quotes from a phone-in service.) If Schmandt elects to have his e-mail read to him, the voice synthesizer obliges by listing the subject lines and the names of the writers before rendering messages in the familiar Rumanian-accented English.



Linked to special software on a workstation, Chris Shmandt's cellular telephone becomes an e-mail and voice-mail center, a digital calendar, a Rolodex, and a news source.

To reply to a message, Schmandt has a choice of voice or e-mail. He can punch in the first three letters of the person's name, in which case Phoneshell grabs the number from an electronic "Rolodex" and dials automatically. "I haven't learned a telephone number in three years," Schmandt admits. If he doesn't have the person's number, he can send an e-mail reply using the phone's keypad. Pressing two buttons to form each letter, he can type 10 words a minute—fast enough to compose a snappy comeback.

On a certain Thursday, Schmandt decides to check his online calendar. The voice synthesizer reads him a list of appointments he has typed in at various times. But he hears his own voice as well: "It's time to deal with some laundry," then "Better confirm those air reservations." To the best of his recollection, Schmandt was on a walk in his neighborhood when he called in the laundry memo, and dressing in front of his speaker phone when he left the other reminder.

Hold That Call

If there's one thing Schmandt has learned about the wired life, it's the importance of filtering incoming e-mail. His group has written software that automatically assigns priority to messages on the basis of who the senders are, where they work, and what they wish to discuss (as revealed in the subject line). This feature is indispensable for using another nomadic service that Schmandt has developed: pager e-mail, where short messages can be forwarded from a computer to the display screen of a paging device. Schmandt, who receives 80 to 100 pieces of e-mail per day, would be driven to distraction if messages not marked urgent reached his pager.

A recent refinement automatically sorts messages by timeliness as well as importance. A message is "timely" if the sender is in the vicinity of the recipient, if it contains proper nouns—such as company names—that are also found in the recipient's calendar, or if it is from someone the recipient has recently e-mailed.

TechnologyReview

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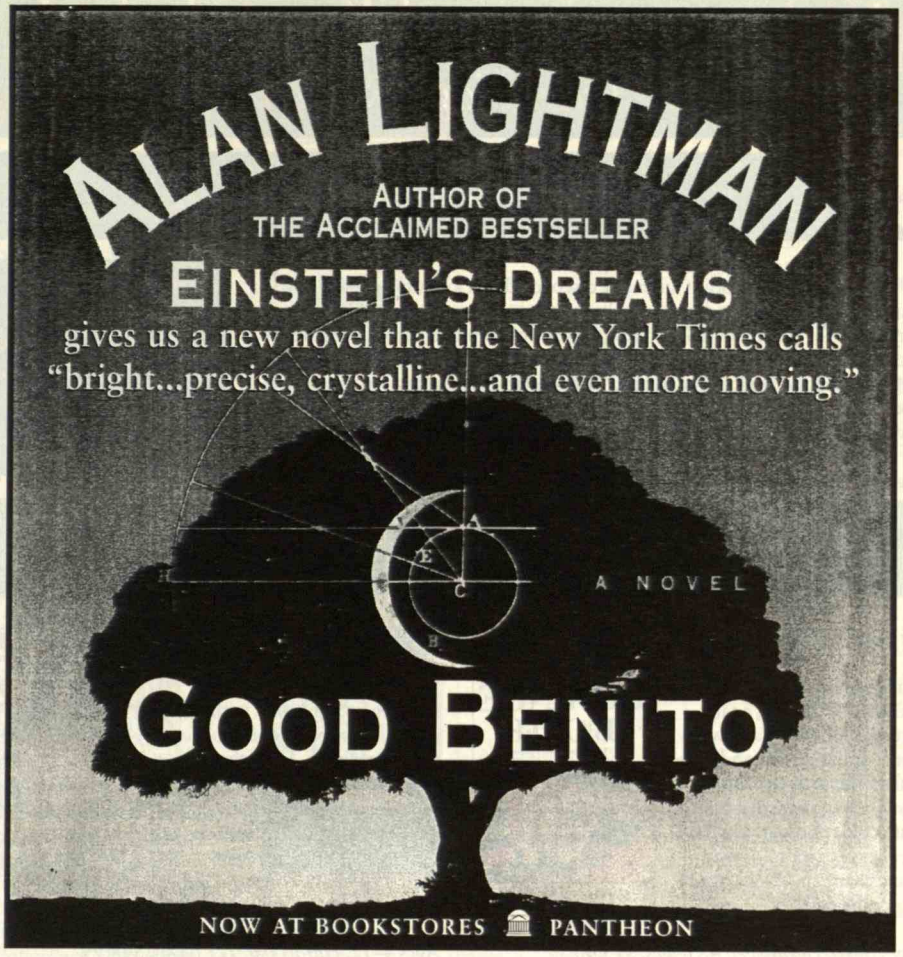
When Schmandt was visiting Lotus Development Corp. recently, the timeliness filter—recognizing the name "Lotus"—made sure his pager received an e-mail message asking him to set up a meeting with someone at the company. "Adding the timeliness filter is the best thing we've done in about a year," says Schmandt.

The group is also working on ways to make the telephone interface more conversational. The addition of voice-recognition technology—an approach Schmandt is now studying for use in the not-too-distant future—would relieve users from having to wade through layers of Touch-Tone menus and learn complicated codes. You would simply say, "My e-mail, please" or "That will be all now, Hawking."

Schmandt is full of anecdotes about how useful this fabric of communication technologies is. Late one evening, for example, while working at his home computer, he received an e-mail query from a friend on the West Coast with whom he was collaborating. Schmandt replied that the answer was complicated and asked the friend to phone him. A few minutes later Schmandt received an e-mail notification that he had new voice mail. The friend, not wanting to disturb Schmandt's sleeping wife and child, had dialed the Media Lab and left the following message, now preserved for inclusion in some future museum of nomadic computing: "Chris, this is Don Jackson. I'm currently driving down 280. I just got an e-mail page from you saying, 'Are you around?' Call the cellular phone number in my car. If you get this, it'll be a miracle." Schmandt reports that he and his friend ended up doing productive work that night.

Saaayyy! Is this technology designed for people who work too much? "It's for people who communicate a lot," Schmandt corrects.—*DAVID BRITTAN*

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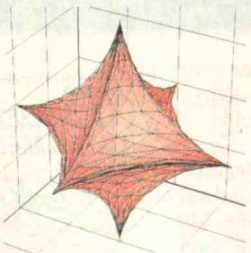
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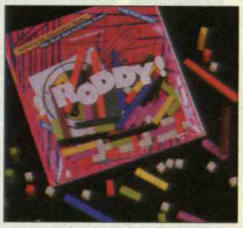
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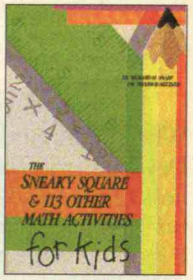
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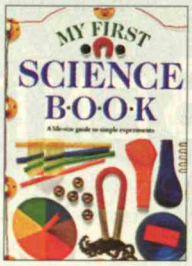


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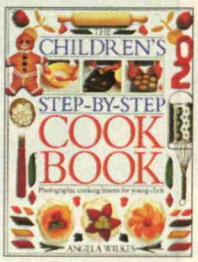


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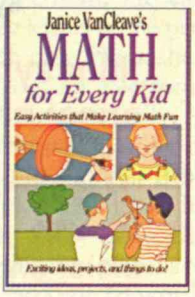


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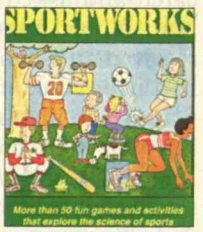


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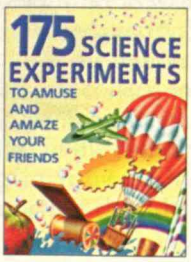


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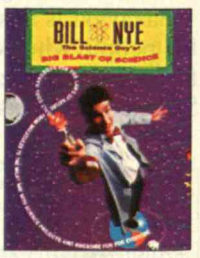


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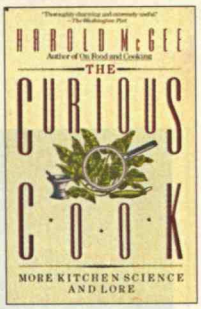


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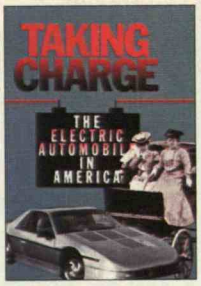


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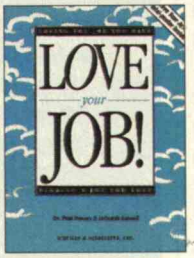
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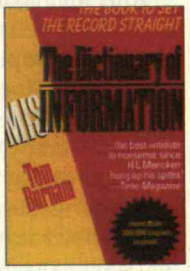


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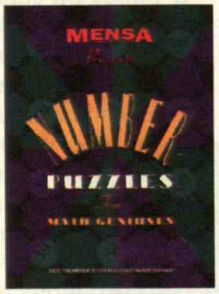
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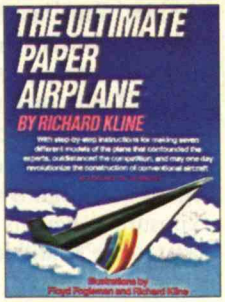
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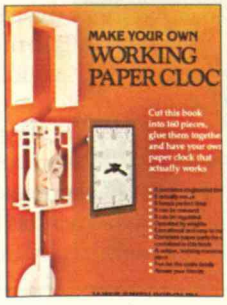


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Trends

Facing Real Fears in Virtual Worlds

The student donned a head-mounted display and plunged into a computer-animated world in which she found herself inside a glass elevator, facing the open atrium of a multistory hotel. At the prompting of her instructor's voice, she pushed a button, then rode upward in the elevator while the atrium floor receded visibly beneath her.

This trip was no joyride into virtual reality. The student, a victim of acrophobia, was trying to face her fear of heights in a controlled experiment of virtual-reality-assisted therapy. Even though the animated scenes viewed were cartoon-like in detail, the student—and nine other acrophobic volunteers—showed actual manifestations of distress, including pounding hearts, weak knees, sweating palms, and verbalizations of fear.

As unpleasant as these symptoms undoubtedly were, they achieved the desired therapeutic effect. Indeed, researchers from Emory University and the Georgia Institute of Technology report that the acrophobic students experienced a significant reduction in discomfort after seven exposures to virtual environments.

More important, most of the subjects showed "meaningful" progress outside the laboratory as well, says Barbara Rothbaum, a clinical psychologist at Emory and the project's co-director. She explains that, although the researchers did not ask the students to seek out frightening situations in their daily lives, 7 of the 10 did so, riding a real glass elevator up a hotel's outer wall or driving a car to the top of a parking deck, for example.

"Our goal was to demonstrate first that people would be afraid in virtual environments and then that the therapy would work," adds Rothbaum's collaborator, computer scientist Larry Hodges of Georgia Tech. "We haven't shown that virtual-reality treatment works better than other approaches, just that it's successful."



Virtual therapy: Students conquer their fear of heights without ever leaving the floor of this Georgia Tech laboratory. Instead, they immerse themselves in a computer-generated world, where, for example, they ride a virtual glass elevator over the open lobby of a high-rise hotel.

Though virtual-reality-assisted therapy makes use of innovative technology, it builds on standard therapeutic approaches. Psychologists have long believed that exposure to the source of one's anxieties can produce a tolerance of fear and a lasting reduction of phobic symptoms. When treating acrophobia, for example, clinicians have used two basic techniques: they ask acrophobes to imagine frightening heights and then encourage them to relax (systematic desensitization), or they guide patients in climbs to ever-higher places (in-vivo therapy).

The researchers from Emory and Georgia Tech are attempting to use virtual reality to treat acrophobia, Rothbaum says, because it offers several advantages over established treatment methods. Patients can confront their fears more vividly in immersive, animated worlds than when simply imagining they are at great heights, while clinicians may find virtual reality more convenient than trips out of the clinic and can tailor treatment to individual cases—for example, by exposing patients to the specific kinds of situations that alarm them most.

After an initial orientation, individuals in the treatment group came to a Georgia Tech computer science laboratory once a week for seven weeks, undergoing 40-minute sessions of virtual-reality-assisted therapy. There, they wore head-mounted displays that immersed them in computer-generated scenes of an elevator in a hotel atrium, a series of balconies, and several open-air bridges strung across a canyon. Under the supervision of a doctoral student in clinical psychology, the subjects progressed at their own pace from one situation to the next.

This study is the first peer-reviewed experiment in which virtual reality has been used to desensitize victims of acrophobia. But last year, psychologist Ralph Lamson of the Kaiser Permanente health-maintenance organization in San Rafael, Calif., reported in the popular press that a group of approximately 40 acrophobes attained significant physiological and cognitive relief after a single exposure to heights in a virtual environment. "We're still looking at the data,"

PHOTO: STANLEY LEARY

Lamson says, "but virtual-reality therapy appears to work well enough to become a standard treatment."

Lamson's group not only experienced elevated heart rates and blood pressure during treatment, but most of them also "felt shaky" during their 50-minute sessions, he says. By the end of the treatment, their heart rates and blood pressure had lowered considerably, and a high percentage of the patients reported feeling less fear, he says. Within three months, 90 percent of these subjects fulfilled Lamson's request that they ride 15 floors in an open, glass elevator.

Treating Other Phobias

Lamson plans to build on his initial research in a study of 300 patients at several Kaiser Permanente facilities this year, exposing subjects to a broader range of virtual environments and testing its effectiveness in treating acrophobia, agoraphobia, and claustrophobia.

Rothbaum and Hodges also plan to test virtual reality's effectiveness in easing the symptoms of other anxiety disorders such as fear of flying. In multiple sessions at a Georgia Tech laboratory, a phobic patient will wear a head-mounted display that projects a visualization of commercial jet flight. The patient will first look at the exterior of the animated airliner on a runway, then "take a seat" inside the jet. There, he or she will hear the sound of the hatch closing, ride in the plane as it taxis across the runway, experience takeoff, fly through good and bad weather, and finally land. Hodges hopes to arrange an actual commercial airline flight at the end of the experiment to assess any changes in the patient's behavior.

Rothbaum and Hodges are also hoping to conduct a pilot study of the effectiveness of virtual-reality-assisted therapy in treating military veterans with post-traumatic stress disorder. The animated environment used in such an experiment will include the sights and sounds of battle, such as the chopping noise of helicopters.

Evidence of virtual reality's effectiveness in treating anxiety disorders would be largely academic if the costs of equipment and software remained out of reach. But in fact they are shrinking, spurred by the growing popularity of virtual reality in the game industry. Hardy Dunn, a program manager at Division, Inc., says that his company's virtual-reality workstations are priced from $40,000 to $80,000—well below the typical $500,000 of five years ago.

Among the challenges to be resolved in future studies is the degree of realism required for virtual environments to trigger a patient's phobic response. "Our goal," Hodges says, "is to figure out the least realistic environment that allows us to have effective therapy." He hopes that minimizing system demands will cut costs.

Aside from questions of economics, technical limitations with virtual-reality-assisted therapy remain. One problem is that as users turn their heads, they experience a slight delay as the computer updates the animated scene to reflect changes in visual perspective. This mismatch between "where you are and where you feel you are," Hodges says, caused some patients in the Emory-Georgia Tech experiment to experience simulator sickness, especially in extended treatment sessions. Subjects in the experiment were able to ward off most of these symptoms by moving their heads more slowly, either on their own initiative or at the suggestion of the research staff. *(See "Knowing Where Your Head Is At," TR February/March 1995, page 10.)*

Physiological barriers may also limit the use of virtual environments in therapy. For example, some people have trouble perceiving the illusion of three dimensions in computer visualizations. Other patients with weakly developed neck muscles, such as young children and bedridden patients, may lack the strength to wear head-mounted displays, which normally weigh from one to five pounds. And some claustrophobia sufferers may not feel comfortable covering their faces with head-mounted displays.

But the most decisive factor in the new treatment's acceptance will probably be the simple willingness of patients and clinicians to give virtual reality a try. Some victims of phobic disorders may shy away from such all-involving encounters with their fears, but Rothbaum believes that the novelty and intrinsic interest of the therapy will attract many others. As for therapists, the virtual-reality approach is meeting some resistance, largely because it is a radically new medium, she says. Still, she hopes that as the technology becomes more commonplace, clinicians will come to accept virtual environments as a "natural extension" of the exposure therapy many already embrace.—*MARK HODGES*

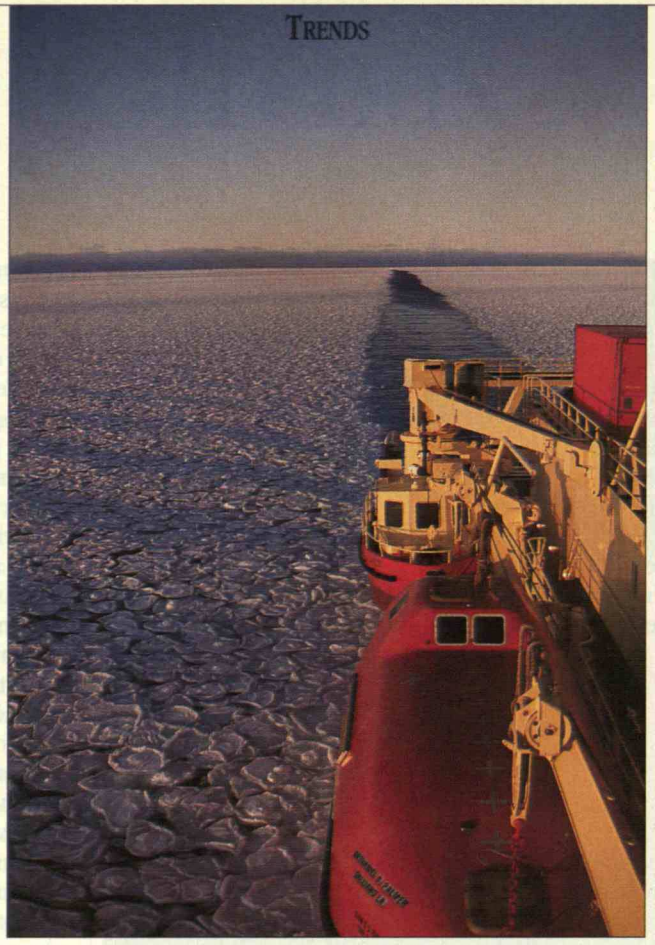


The virtual elevator experience is realistic enough to give acrophobia victims pounding hearts, week knees, and sweaty palms. After repeated exposure, patients become desensitized and no longer suffer from such symptoms in either the virtual or the real world.

PHOTO: LARRY F. HODGES, ROB KOOPER, THOMAS C. MEYER

Life in the Deep Freeze

It's difficult to comprehend that there exists on earth an ecosystem twice the size of the United States that remains essentially unknown. But the Antarctic winter sea ice and its treacherous inaccessibility have kept scientists fooled and at bay for decades. Only now are researchers beginning to unravel its mysteries. One set of collaborations between biologists and ice physicists, strange bedfellows brought together by the unexpected complexities of the Antarctic winter pack ice, is explaining the appearance of organisms that live in the ice.



Unlike Arctic sea ice, which gradually thickens in relatively calm waters from a thin sheet into a heavy winter blanket, sea ice in the stormy Antarctic winter aggregates into "pancakes" that cement together, only to be torn apart in the tempestuous waters. The resulting channels and fractures serve as habitat for a surprising variety of species.

When people think of Antarctic ice, most envision the great freshwater icebergs that calve from the southernmost continent's glaciers and sail north. Although the Antarctic continent is covered with a layer of frozen snow thousands of feet thick, there's another type of ice cover— salty ocean water that freezes and grows around much of the perimeter of the continent.

In the Antarctic summer months—December, January, and February—the continent is rimmed with about 1.5 million square miles of sea ice. But in March, the Southern Hemisphere's first month of autumn, a phenomenon occurs that biologist David Campbell, author of *The Crystal Desert*, called "the greatest seasonal event on earth." The air temperature drops as low as minus 40° F to supercool the sea ice, which freezes at 29° F. The pack ice begins growing at the incredible rate of more than 2 square miles per minute. By the end of the Antarctic winter, in September, the pack ice has expanded to more than 7 million square miles—nearly twice the size of the United States—in a layer usually no more than three feet thick.

Until recently, scientists thought that the Antarctic winter sea pack was a monolithic sheet of ice, like lake ice, and devoid of life, which died, fled, or hibernated on the bottom of the Southern Ocean until the earth's orbit once again brought the southern pole in line with the sun's vital rays. But in the last few years, as the first ice-breakers used for oceanographic research timidly penetrated deep into the crushing winter pack, scientists have had to adjust their perceptions. They know now that the sea ice pulses—continuously diverging, converging, breathing, and refreezing—while harboring an active plant and animal life, even in the depths of the austral winter.

The first characteristic noticed by glaciologists— scientists who study the physics of ice and snow—was the striking difference between the ice that grows in the polar seas of the Arctic and that of the Antarctic. In the Arctic, most of the ocean is surrounded by land and the waters are relatively calm. Most sea ice thus is able to form with flat, floating crystals called frazil that align in a thin skin that thickens, turns gray and then white. Because little insulating snow falls on this ice, extremely cold temperatures stimulate the growth of long, graceful columns of ice crystals called congelation that grow from the bottom of the pack, which thickens to five or six feet. Caught in a closed circular ocean current called a gyre, much of the ice survives the summer to double in thickness the following winter. Because of the thick ice and the lack of an insulating blanket of snow, relatively little life exists in Arctic ice.

Conditions in the Antarctic, surprisingly, are more conducive to life. In contrast to the enclosed and relatively calm Arctic seas, the Southern Ocean surrounds the continent and is continually buffeted by cyclones that howl around the perimeter. Antarctic winter sea ice is thus often born as a thin film of so-called "grease" ice that, at a distance, looks like long yards of black silk thrown across undulating waves. This film comprises the same frazil crystals that form the thin skin of Arctic ice. But when waves push and pull at the tiny crystals, "the soupy mess aggregates into circular ice called pancakes," explains Martin Jeffries, a glaciologist at the University of Alaska. In some areas, white ovals of pancake ice, one or two feet in diameter, stretch like frozen lily pads as far as the eye can see.

The floes thicken mostly by rafting over each other, and cement together to grow to more than a mile in diameter. But because of the insulating effects of snow cover and the action of ocean waves, the floes usually grow no more than three or four feet thick.

When they began venturing into the

PHOTO: JANE STEVENS

winter pack ice, biologists were startled by the magnificent variety and concentrations of algae growing in the winter ice. They were unable to explain such accumulations until recently when they analyzed information gleaned in the mid-1980s by glaciologists Stephen Ackley, with the U.S. Army Cold Regions Research Laboratory in Hanover, N.H., Willie Weeks, at the University of Alaska Geophysical Institute, and Peter Wadhams of the Scott Polar Research Institute at the University of Cambridge. The researchers had reported that during pancake ice formation, frazil ice crystals churned as in a snowstorm through the few meters of water at the surface.

That discovery led David Garrison, a marine biologist at the University of California at Santa Cruz, to speculate that as the crystals rise to the surface, they pick up tiny drifting plants, called phytoplankton when they float free and algae when they're living in the ice. In laboratory experiments in 1990, Garrison proved that, as crystals rise to the surface, they scavenge microorganisms, which cling to them for dear life in the turbulent water.

Ackley had also proposed that waves passing through grease ice could pump in more microorganisms from the water. And in 1990, biologist Gerhard Dieckmann, at the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven, Germany, verified the theory by finding higher levels of microorganisms in grease ice undulating on waves than in the water column below.

A major question was where exactly these organisms live. The answer lies in the fact that when sea ice freezes, it squeezes out salty brine that forms channels and pockets. German glaciologists were first able to see these channels clearly in 1992, when techniques were developed to make casts of ice interstices. The frazil ice crystals form in a maze of tiny interconnected channels, which are large enough for algae to live in.

When ice floes submerge under the weight of continual snowfall or are pushed underwater in a collision with another floe, nutrient-rich seawater



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floods the surface, and organisms can also grow at the snow-ice interface. Scientists speculate that perhaps hundreds of species make their home in between the crystals of ice, but the paucity of voyages into the winter-sea pack ice and the difficulty of gathering and preserving samples has revealed only a tiny portion.

Frozen Food Chain

What is known is that these ice organisms form the basis of the food chain that supports the many birds and mammals that thrive in the Antarctic winter sea ice. Thousands of Adelie and emperor penguins, as well as crabeater, Weddell, and leopard seals live in the winter pack ice and hunt for food in fractures called leads, which look like rivers running through flat snow-covered farmlands and that result from the ice's constant motion. Long-winged Antarctic petrels and snow petrels, and occasionally giant petrels, also rely on life among the fractures for food.

Numerous questions remain about how the physics of ice formation affects life in the Antarctic and, conversely, how the biology of the region affects the ice cycle. Do the physical and biological characteristics of different parts of the region cause "oases" or "deserts"? Do different habitats favor different species of algae? How does dark algae in the ice affect its light absorption and temperature and thus its properties, especially as the ice breaks up in the spring?

Cornelius Sullivan, director of the National Science Foundation's Office of Polar Programs, anticipates that satellites will eventually be used to characterize features of the vast 7 million-square-mile ice cover and figure out which species live where. But the key to answering the remaining questions, he says, is more interdisciplinary research in environmental science. Sullivan should know. In his career in studying the Antarctic winter ice, he began as a marine biochemist, moved into marine biology, studied physical oceanography, and even did research in satellite imagery.—*JANE E. STEVENS*

Biological Warfare on the Farm

When Jo Handelsman, a plant pathologist at the University of Wisconsin-Madison, asked two students to yank some alfalfa plants out of farmers' fields back in 1985, she wasn't advocating agricultural sabotage. Rather, she was looking for an organism that would destroy Phytophthora, the fungus that caused the Irish potato famine 150 years ago and continues to rot the roots of alfalfa and many other field crops in the cool, moist spring of northern latitudes.

Why did Handelsman expect to find such a useful organism? Because she sees the struggle for survival operating in the soil just as it does everywhere else on the planet. In the same way that lions and cheetahs on the African savanna attack with claws and teeth, microbes in the soil must use chemical weapons to repulse, kill, or eat their enemies. After all, isn't this microscopic struggle for survival the origin of penicillin, which is produced by fungi to kill bacteria? And don't these bacteria, in turn, retaliate by producing their own arsenal of antifungal chemicals? Surely, if Phytophthora is prevalent in the soil, she assumed, some organism would have evolved a means to fight it.

The students rinsed organisms from the alfalfa roots and placed them on culture dishes. Three months and 1,000 cultures later, Handelsman had her grail—a local strain of a soil bacterium that in lab tests produced an antibiotic that would defend the plants against Phytophthora.

Since then, the strain—dubbed UW85—protected numerous crops, including alfalfa, cucumber, peanuts, tobacco, tomatoes, and soybeans during six years of field tests in five midwestern states. In one test, for example, it increased soybean yield by 2 bushels per acre (4 to 12 percent, depending on the yield), only a half-bushel less than beans treated with metalaxyl, a common chemical fungicide.

Handelsman's work is part of a larger trend of fighting pests and diseases with living agents—to tap the natural antagonism among organisms and put natural selection to work for farmers. Janet Anderson, director of the Office of Biopesticides and Pollution Prevention at the Environmental Protection Agency (EPA), says the burgeoning interest in biological controls stems from their potential to increase crop yield and farmer profits with relatively few drawbacks. "We believe they tend to be safer than the chemical alternatives," she says, citing the reduction of damage to organisms other than those they target and lower levels of groundwater pollution from chemical pesticides.

Microscopic battlefield: When the soil fungus Phytophthora (near right) attacks the roots of an unprotected soybean plant (middle), the plant quickly shrivels and dies. But when Phytophthora's natural predator, a bacterium called UW85 (far right), is present, it destroys the fungus, enabling the plant to continue to grow normally.

Despite their theoretical advantages, however, biocontrols have a tough row to hoe. According to an industry report by the Freedonia Group, an agricultural consulting firm, although all biological controls of insects, weeds, and diseases are expected to grow nearly 20 percent annually, they won't soon make much of a dent in the $27 billion global pesticide industry. But Handelsman hopes that UW85 will bypass some of the obstacles to biocontrols, such as effectiveness limited to narrow regions and insufficient hardiness or ability to thrive. She points out that because this type of bacteria forms tough, hard-to-kill spores that "easily last 10 years and survive boiling temperatures," it can withstand the tem-

perature extremes of shipping, storage, and handling that plague less hardy biocontrol agents, such as the pseudomonas bacterium used against "take-all," a wheat disease that chemical fungicides cannot control. "Spores are very appealing for commercial products, since they offer a long shelf life," she says.

LiphaTech, a Milwaukee subsidiary of Lipha Pharmaceuticals of France, has applied for EPA registration for UW85, which was patented by the Wisconsin Alumni Research Foundation. Stewart Smith, director of microbial research at LiphaTech, says that the company hopes to market a product for soybean crops in the upper midwestern states within the next year or two. He expects that the UW85-based fungicide will be much cheaper than liquid metalaxyl and, as Handelsman's tests showed, nearly as effective.







Acting Locally

A hurdle that promoters of UW85 and all biocontrols must surmount is ensuring that the organisms will multiply enough to survive and become effective killers once they reach foreign soil. Indeed, soil microorganisms are notorious homebodies; as a rule, they prefer the structure, chemistry, temperature, and microbial composition of their native soil.

Arthur Kelman, a plant pathologist at North Carolina State University, attributes the slow development of biocontrols partly to ignorance about such factors. "I think that advocates for biocontrols have had a naive view that there would be one major strain of fungus X or bacterium Y that you could use like a chemical, and a company could manufacture it, and all our problems would be over," he says. "That's not true."

Alan Paau, a bacteriologist who directs patent licensing at Iowa State University, concurs. "If you use a biological agent, it has to be able to survive in the local environment," he says. "So the best organism is one that is found locally."

To pluck out the strains of the UW85 bacterium that would kill Phytophthora from the many local varieties that exist in the soil, Handelsman and one of her students, Eric Stabb, recently developed a quick and simple test that requires just a few hundred dollars' worth of lab equipment. The test uses a virus—which Stabb discovered serendipitously in 1991 while doing basic research—that attacks only UW85 strains that produce the Phytophthora-fighting antibiotic. After dividing a colony of bacteria in half, the researchers infect one group with the virus. If the colony dies, then that strain (which is surviving in the twin colony) fights Phytophthora. The test simplified the search for effective bacteria from three months of field work to one day of lab work.

Handelsman has since used the test on soil organisms from the United States, Australia, the Netherlands, and Central America, and found disease-fighting variants of the UW85 bacterium in every soil she tested. With such a test come "all sorts of rural, small economic opportunities for developing biocontrols," she says. For example, businesses or farm cooperatives could grow effective strains of locally adapted bacterium in fermentation tanks, collect the spores, process them, and sell them to farmers who in turn could dust them on crop seeds or plant them in the soil.

Paau, for one, worries that this approach could get bogged down in regulatory red tape, since each site-specific strain would have to be tested and approved by the EPA. However, EPA's Anderson points out that the agency is looking at new ways to work with companies large and small to streamline the approval, for example, by allowing one permit to cover more than one strain. "We will approve alternative formulations whenever the health and safety data are the same for all strains, which is often the case," she says. "In the regulation of biopesticides, lots of innovations are needed."

—*David Tenenbaum*

PHOTOS: LAURA SILO-SUH, STEVE VICEN; STEVE VICEN, JO HANDELSMAN; STEW SMITH

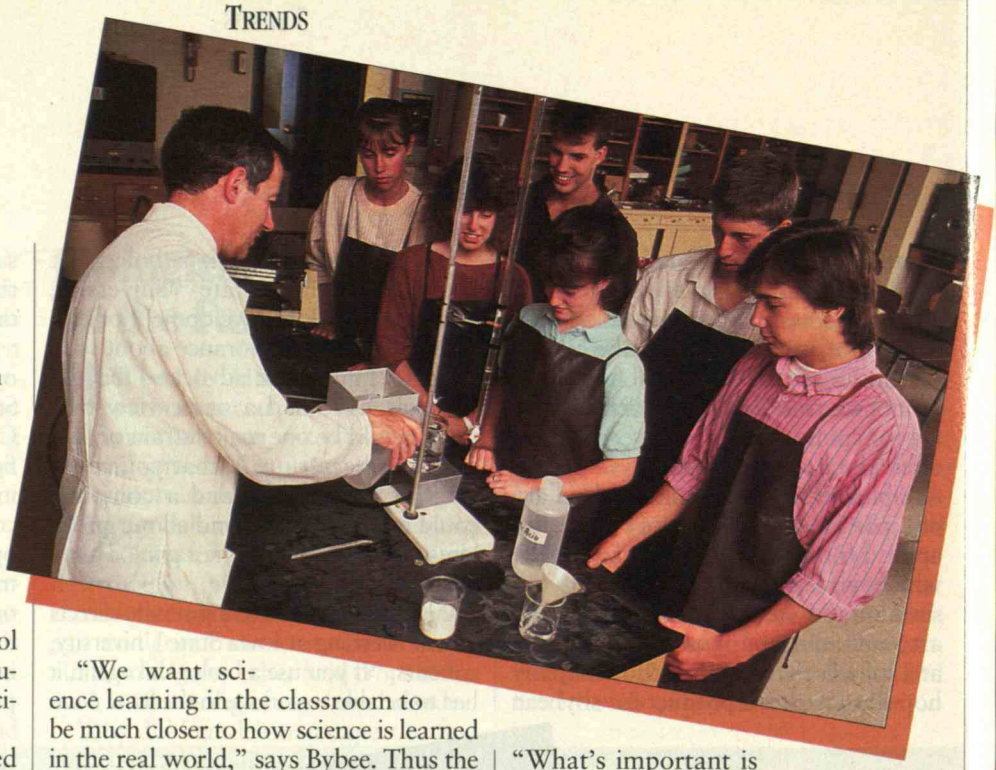
Integrating the Science Curriculum

About the only thing experts in science education agree on these days is that U.S. students have continued to fall short of what they need to know about science if they hope to function in today's technical society. But science educators have been frustrated in their attempts to reform the current system not only by disputes over course content but also by school districts and administrators who are cautious about innovative approaches to science education.

Now a new set of standards created by the National Academy of Sciences (NAS), in collaboration with teachers' organizations, parents' groups, and science organizations (including the National Science Foundation and the American Association for the Advancement of Science), may be the catalyst for the kind of change reform advocates have been hungry for. "We're talking about a new vision for science education in America," says Hubert Dyasi, professor of science education at the City College of New York and a member of the NAS group that produced the new standards.

In fact, the National Science Education Standards, as they're called, aim to implement both new ideas as well as older ones that have long been acknowledged but seldom put into practice. For example, one familiar learning approach it embraces, heretofore largely ignored, is known as "science as inquiry." The notion is that the process of learning how to ask the right questions, which in turn spawns the most effective investigations, is more important than coming up with the "right" answer.

Unfortunately, says Rodger Bybee, chair of the NAS working group on science content standards, "today there's still a lot of emphasis on formulas and definitions, but not on investigation and observation." For example, in most science classrooms, students are given, say, laws of physics, and then told to do experiments that demonstrate those laws.



"We want science learning in the classroom to be much closer to how science is learned in the real world," says Bybee. Thus the reformers are proposing that school kids do experiments before they are asked what they can conclude from them. Only at the end of the exercise would students learn the accepted theory.

Perhaps the most radical proposal is to integrate the science curriculum. Rather than offering students separate science classes—ninth-grade biology, tenth-grade chemistry, eleventh-grade physics—the standards encourage biology, chemistry, and physics instructors to work together and teach students about all of the disciplines every year.

Students will learn how the different science disciplines interact and overlap, rather than seeing them as isolated pursuits. This approach more closely reflects how science can be used to deal with common problems since, for example, questions about pollution involve not just the chemistry of toxins but also their physical effects on the environment and their biological effects on people, animals, and plants.

When it comes to convincing schools to implement these concepts, reformers expect the stamp of approval the standards bear to be as persuasive as their actual content. "I don't think the standards recommend anything that science educators don't already know," says William Spooner, director of high school education for the North Carolina Department of Public Instruction and a member of the NAS advisory committee. "What's important is the credibility of the national science experts," he says. "Local administrators may not be likely to heed the advice of their science teachers, but they will pay attention to something like this."

Richard Klausner, chief of the Cell Biology and Metabolism Branch at the National Institute of Child Health and Human Development and chair of the advisory committee that drafted the new report, concurs. Teachers can begin to use the guidelines to develop their own classes and curricula and then use the report to defend their experimental techniques to school administrators, he says. Administrators, in turn, can use the report to defend the changes they want to make in their science programs to the school boards. And the boards can use the report as ammunition in attempts to revise their state's overall science education policy as well as lobby for money for teacher training and new materials to eventually implement the changes on a large scale.

Meanwhile, Bill G. Aldridge, executive director of the National Science Teachers Association, hopes to prove the value of the report's ideas by putting them into practice. Since last fall, he has been working with a five-year, $4 million grant from the National Science Foundation to introduce the new concepts in 15 schools around the country.

Aldridge's group will begin by requiring science teachers in those schools to

PHOTO: COMSTOCK

New standards from the National Academy of Sciences for teaching high-school science call for rolling biology, chemistry, and physics classes into one course taught over several years. The goal is to help students tackle real-world problems, most of which require contributions form several scientific disciplines.

attend a three-week seminar this summer that will explain the curriculum they will implement in the fall. One obvious change is that there will be no textbook for the class, since traditional texts do not fit the new approach. Instead, Aldridge's group is creating its own instruction manuals for teachers and work packets for students. The materials will pool information and experiments from different science books that are consistent with the group's content standards.The teachers will also require students to do a considerable amount of outside reading. Teachers will identify articles in popular science magazines, newspapers, science books, even science-fiction novels.

Students will be given a set amount of time each week in class to discuss observations that they have made in their own lives. For example, they might ask how the colors of the sunset are made in the sky every evening, whether Alka Seltzer dissolves faster and more completely in hot water, or why a microwave oven cooks food so much faster than a conventional oven.

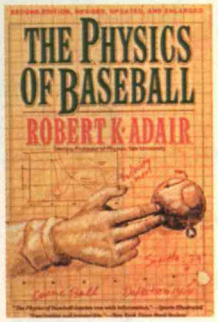
Finally, lab experiments will take on greater importance. The focus will be on allowing students to devise experiments to help answer their own observations. For example, they could set up an experiment to compare how Alka Seltzer dissolves in water at different temperatures. The teacher could then use the results as a springboard to discuss relevant science concepts.

Aldridge believes that once these pilot projects begin to show results, the new concepts will become the norm. "By the year 2000," he predicts, "we're going to see a noticeable change in thousands of schools around the country."

—*Mubarak S. Dahir*

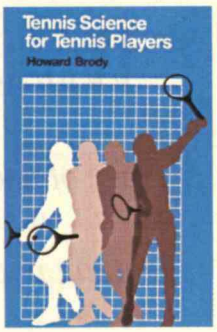
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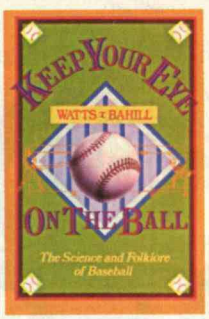


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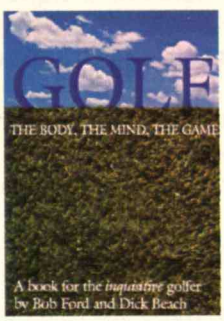


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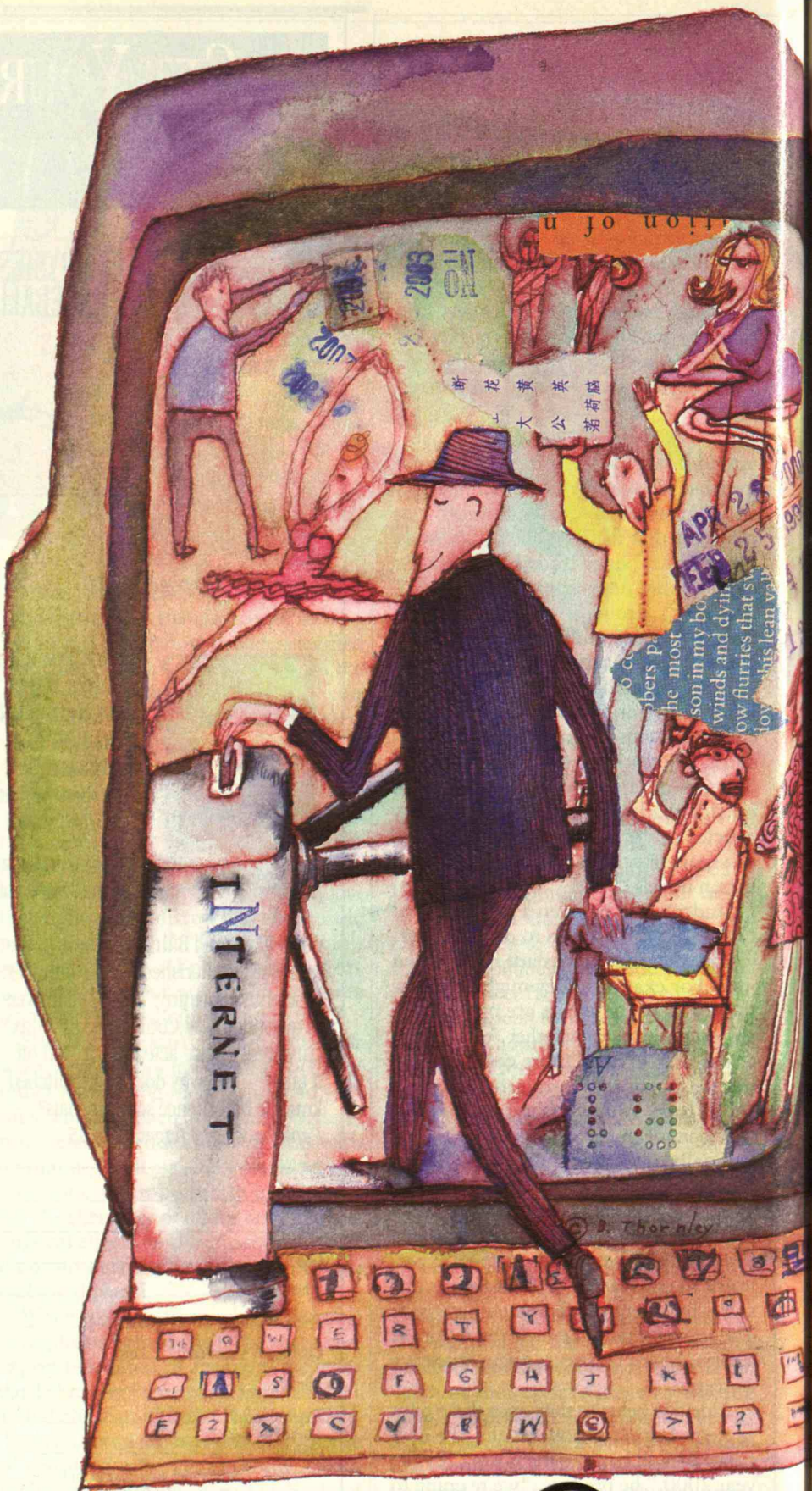
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With its growing ease of use and burgeoning popularity, the Internet is fast becoming the all-purpose information superhighway we've been hearing so many promises about. But can it survive the transition from a government protectorate to a free-market medium?



<INTERNET@CR

BY HERB BRODY

AS WITH ANY ROMANCE, the world's present infatuation with the Internet has emphasized the magic and tended to ignore the practical. Couples falling in love dote on each other's wonderful traits. It is only a little later that they float down from the clouds and tackle the economics—how big a house they can afford, what kind of income they will need. ❑ The Internet, for most people, is still a new love. Ignore for a moment the few tens of thousands of people who inhabited the Net before the phenomenal population boom began in the late 1980s. For the rest of us, the Internet is still exciting and not a little bit mysterious. ❑ But the oddity is that nobody seems to be paying for all the informational goodies that can pour into our computers like water from a broken pipe. You might pay a few dollars a month for the privilege of being connected, but once you slide past the electronic turnstile, it's an all-you-can-consume buffet of bits, from plain vanilla e-mail to participation in online discussion groups to searches of Library of Congress databases to the latest satellite images of the planet. Want to send a 10-page letter to a friend in Australia? Go ahead—no extra charge. Want a nifty piece of software that lets you browse the Net by pointing and clicking? Take it, it's free. Want to mail a fund-raising appeal to 10,000 people? The Internet converts this from a $3,200 postal endeavor into one that's more or less on the house. Internet users seem to have found a kind of surreal

ILLUSTRATIONS BY BLAIR THORNLEY

OSSROADS.$$$ >

restaurant where they can order a bottomless cup of coffee or a lobster dinner for 100 friends and no one ever presents an itemized bill.

Part of the reason is that, at least until the last few years, most members of the Internet Nation plugged in through computers at their workplace or university, so costs were a kind of invisible overhead that someone else worried about. At MIT, for example, a high-speed fiber-optic network called MITnet links computers all over campus. One of these computers serves as a "gateway" that connects MITnet to one of 17 regional networks, in this case called Nearnet and operated by Bolt Beranek and Newman, a Cambridge-based technology consulting company. Nearnet, in turn, is connected to a "backbone" known as NSFNet because it is funded by the National Science Foundation. NSFNet itself is operated by ANS, a not-for-profit company that has leased high-capacity fiber-optic telephone lines from the same companies that handle long-distance telephone traffic—AT&T, MCI, and Sprint. Each organization pays a flat rate to the broader system it taps into; individual users are essentially insulated from cost burdens regardless of the volume of their use.

With similar hierarchical connections, commercial on-line services such as Prodigy and America Online give individual subscribers e-mail privileges on the Internet as well as access to some of its more popular resources, such as the Usenet newsgroups (online bulletin boards on hundreds of topics). These commercial services are heavily promoting such connections, particularly the ability of subscribers to tap into the World Wide Web, an interwoven collection of Internet resources that allows point-and-click navigation without mastery of arcane commands. But although this access brings entrance into an electronic universe where interactivity is not just a marketing slogan but a way of life, the cost is usually just a fraction of what users pay for cable television.

That situation may change as the Internet detaches from the government umbilical cord that has nurtured it through its infancy. Beginning April 30 of this year, the NSF will no longer pay to operate the backbone network. The portion of NSF funding that goes to the 17 regionals is also now on a five-year "sunset schedule," dropping gradually to zero by fiscal 1998.

Under the new arrangement, the federal government will grant this dwindling amount of money directly to each regional network and instruct it to shop for backbone service on the private market. The transition resembles, in one sense, the breakup of the Bell System a decade ago. But the government is not stepping out of the Internet picture altogether. NSF is setting up and funding three "network access points," or NAPs; any company that wants to operate an Internet backbone must connect to each of these three NAPs, which are to be located in New Jersey, Chicago, and California. To qualify as a backbone service provider, a company must agree to accept Internet transmissions that arrive at each NAP from every other backbone company.

Millions of people enjoy low-cost access to the Internet's information cornucopia. Now, without the federal subsidies that have built and sustained it, the Net will have to make it on its own—forcing decisions on whether, and how much, users might pay.

The withdrawal of a large part of government support will not by itself significantly raise prices for users. NSF's total funding for the Internet is only about $20 million a year. The companies, universities, and individuals that use the Net pay many times that amount, and dividing that $20 million over the number of present users yields only about $1 per person per year. As the Net grows in popularity, that burden may diminish further. What worries some analysts, however, is that the nature of information being sent over the Internet is changing rapidly, with potential implications for the system's cost and ease of access.

Digital Congestion

Until about two years ago, the overwhelming majority of Net users were transmitting simple text such as e-mail messages and Usenet postings. Text is a highly efficient method of communication: the words composing a page of the *Encyclopedia Brittanica*, for instance, can be encoded in standard ASCII form using fewer than 10 kilobytes. But new software and more powerful desktop computers have made it practical to send high-resolution color images, sound files, even full-motion video—anyone with a camcorder and

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a multimedia computer can conduct a videoconference, for example, over the Net. Such uses consume orders of magnitude more capacity, or "bandwidth," than text. By swamping the network with video signals, relatively few users can temporarily overload portions of the Net.

The World Wide Web has the potential to exacerbate this problem, since Web browsers can easily, almost inadvertently, trigger the transmission of huge amounts of data. Wave a mouse around the screen, click once on an appealing picture, and megabytes start flowing. Without the Web, users must type in a command to retrieve that information—a step that can at least give them pause.



To understand both the Net's capacity to transmit such information and its vulnerability to overload, compare it with the familiar telephone system. That network uses a technique known as circuit switching: when you dial your grandmother's number, you are instructing the system's switches to establish a connection between your telephone and hers. This connection is maintained for the duration of the call: as long as you are on the line, no one else can use this circuit. You are consuming a scarce resource and pay for the privilege.

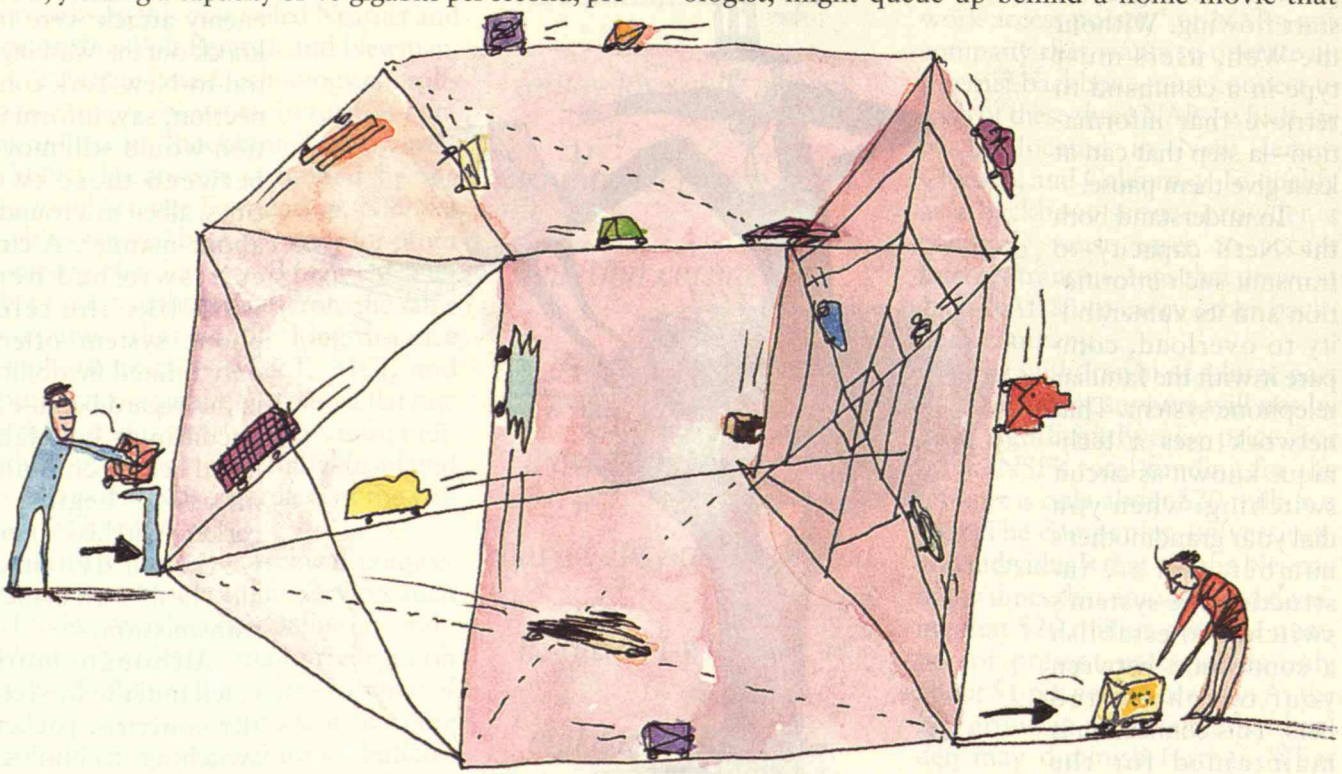
Although most Internet traffic physically flows through the telephone wires, information is packaged and routed much differently. Each transmission is broken up into discrete "packets" containing roughly 200 bytes (packet size varies). Each packet is stamped with the recipient's address. The packets then bounce from computer to computer along the Net, each computer examining the address and deciding where to send them next for the most efficient transmission. Since these decisions depend on conditions at the moment, the packets may travel different routes to reach the same destination. Eventually all the packets arrive at the receiving computer, which reassembles them into the original form.

This structure—or architecture, as computer scientists like to call it—stems in part from the Internet's origins as a defense project. A packet-switching system is difficult to eavesdrop on, since messages are scattered to the electronic winds before finally coalescing at the receiving point. The design also lowers the risk that a military attack would disrupt communications—a primary concern in the 1950s and '60s when ARPAnet, the Internet's ancestor, was designed by the Pentagon's Advanced Research Projects Agency. The reasoning was brutally straightforward: if an enemy attack were to knock out the Washington-to-New York connection, say, information would still move between these two cities, albeit in a roundabout manner. A circuit-switched network like the telephone system offers only limited flexibility in this regard because a circuit must be established before communication begins; a packet-switched network can dynamically "heal" itself in midtransmission.

Although motivated initially by security concerns, packet-switching technology has profound implications for the economics of network communications. When someone sends something over the Internet—say, a piece of e-mail—the packets do not consume a scarce resource in the same way that a phone call does. If a router is busy, incoming packets simply queue up and wait their turn. Longer lines translate into delays, not busy signals. For the uses of the Internet that have prevailed so far, such lags don't make much difference. Unlike telephone conversations, which take place in real time, e-mail communications can easily tolerate delays of many seconds or even minutes. However, the advent of multimedia services on the Internet is making delays less tolerable. If packets queue up at a router, quality of service can deteriorate; video appears jumpy, for example, and moving from one World Wide Web link to another can take so long that the medium becomes more an annoyance than an adventure.

It is possible that advances in technology will pro-

vide the needed capacity. The best fibers used in the long-distance links that carry both voice and data traffic can accommodate 2.4 gigabits (billion bits) per second. Over the next two years, upgrades to optical transmitters and receivers will quadruple that data rate. Even better, after more than a decade of development, telecommunications engineers are perfecting a system called wavelength division multiplexing, which enables a single fiber to carry multiple channels of information, each encoded on laser light of a slightly differing wavelength. Such multiplexed systems will be in place by 1998, yielding a capacity of 40 gigabits per second, predicts Vinton Cerf, a senior vice-president at MCI's data services division and president of the Internet Society, a nonprofit organization that promotes Internet usage and standardization. These radical leaps in performance are coming as costs of all component technologies—fibers, lasers, and electronics—decline. Technology, in other words, has the capacity to abolish near-term bandwidth scarcity.



Still, if the recent past is any guide, the demand for bandwidth will grow at least as fast as the supply. According to University of Michigan economist Hal Varian, while NSFnet now operates at only 5 percent of capacity, the volume of packet flow is rising by 6 percent per month. At that rate, average traffic volume will reach 20 percent of capacity in only two years. During times of peak use, however, the amount of information put onto the Net far exceeds this 20 percent average, and packets that don't "fit" have to wait until a channel is clear. As the Internet is used more and more for real-time forms of communication such as videoconferencing, such delays become intolerable.

Congestion on the Internet is already hampering attempts to use it for new applications during peak business hours, says Jeffrey Mackey-Mason, an economist at the University of Michigan. The problem becomes particularly acute when some special event occurs. After the comet Shoemaker-Levy struck Jupiter, for example, and people downloaded the dramatic telescope images, large portions of the Internet slowed down. In such situations, urgent transmissions, such as a potentially life-saving videoconference between a surgeon and a radiologist, might queue up behind a home movie that someone put on the Net just for fun. In effect, the Net can be dominated by people with a lot of time on their hands, and there is no provision for buying one's way to the front of the line.

To Charge or Not to Charge

Some analysts therefore contend that the nation needs some kind of disincentive to unbridled consumption of the Net's capacity. If people have to pay for what they do, they will tend to do less, says Padmanabhan Srinagesh, an engineer at Bell Communications Laboratories, or Bellcore. Net users, in other words, might have to say goodbye to the freedom of a flat rate. The Internet would instead be metered, with users paying by the message, by the byte, or by the Web page, just as they now pay by the kilowatt-hour for electricity or by the minute for long-distance phone calls.

Philip Gross, vice-president for Internet engineering at MCI's data services division, agrees that some sort of

usage-based pricing is "inevitable," if only so the multiple companies handling backbone traffic can count packets and settle accounts with one another. But the solution to the problem is not as simple as counting packets or bytes. Take a typical transaction: the transfer of a large software file. User A sends a 100-byte request to User B, who responds by transmitting a 1-megabyte program. A naive billing system would charge User B 10,000 times more than User A, even though User A initiated the transaction and received all of its benefits.

Opponents of fees argue that they would rob the Net's vitality as a workplace, playground, and social club. The electronic culture that extols instant and perpetual electronic connectedness presupposes that people will not have to fret over a ticking fare meter in cyberspace. Usage pricing might especially dampen the enthusiasm of school and home computer users. "We should be trying to preserve the motivation of people to use the Internet," says David Wasley, director of computer network services at the University of California at Berkeley. The recent introduction of usage fees in Australia, Wasley says, led to a rapid decline in e-mail sent by students.

Not-for-profit organizations that have begun to rely heavily on Internet mailing lists to reach activists and potential donors are particularly vulnerable to pricing changes. Any kind of per-use charge will have a chilling effect on some of these fledgling exercises in "electronic democracy," asserts James Love, president of the Washington-based Taxpayers' Assets Project, a group that monitors the outcome of privatization efforts. "Say you send a message a day to everyone on a 10,000-name list," he says. "If you have to pay per transaction, that adds up."

Other complications arise as well. Part of the Internet's value—and charm—lies in its utter transcendence of geography. In today's system, a Net surfer who downloads pictures of Jupiter need not care whether the computer holding these images is 10 miles or 10,000 miles away. All information stored in any computer on the network is, in effect, stored everywhere. Because the Net has traditionally rendered geographical distance a secondary concern, users often don't even know exactly "where" they are traveling. "If you try to charge based on distance or on the number of bits, then the Internet falls apart," says Edward Krol of the University of Illinois, author of *The Whole Internet User's Guide & Catalog*. "If the best resource happens to be in Belgium, you just use it."

Information sent through the Internet is broken into small "packets" that can travel along a variety of independent paths to reach the same destination. This architecture makes the Internet efficient but still vulnerable to overload.

Fortunately, the present flat-rate pricing does have some built-in protection against network congestion. As it now stands, the cost of Net access varies with the bandwidth of the basic connection. A user operating from a home or office with a 9,600-bit-per-second link pays less than a business with a 56-kilobit-per-second connection. The size of this "pipe" limits usage just the way the size of a house's electrical service limits the amount of power it can draw off the grid. Nevertheless, when millions of Net users raise their expectations of what is possible on the network, "the Internet will melt," maintains Scott Shenker, a researcher at Xerox's Palo Alto Research Center.

One way to avoid any potential crisis is to outfit the Net with mechanisms that perform electronic triage. Usage that cannot tolerate delays, such as real-time videoconferencing, would be stamped high priority and sail through the Net like an ambulance with siren wailing. Users would pay their Internet provider a premium for this special treatment. Shenker points out that such priority-based preferences would lead logically to usage-based pricing, since people would think twice about conducting real-time videoconferences if they had to pay dearly for the privilege of displacing so much other activity. Most users would routinely put a lowest-priority tag on e-mail and text postings to newsgroups, which rarely require rapid delivery, and the fees paid by senders who demand high priority would subsidize any cost associated with such transmission.

Although companies that provide Net access have stuck mostly to flat-fee structures, they may start promoting congestion pricing as a marketing edge as the number of providers proliferates. Many users will presumably appreciate the ability to pay for what amounts to a guarantee of immediate transmission.

One barrier to such a move is that today's network has no means of tracking packets sent and received. All

Internet communication is governed by a set of rules, or "protocols," called TCP/IP (transmission control protocol/ Internet protocol). TCP/IP specifies the method by which any digital data—whether they represent text, graphics, or anything else—are transmitted, routed, checked for errors, and, if need be, resent. But nothing in the protocols provides the detailed information that commercial telecommunications companies need to provide a billing record, says MCI's Gross.

Even if the protocols did gather such information, the accounting process is bound to be expensive. More than half of what customers pay for a telephone call goes to cover the cost of the accounting system, contends Wasley. Thus any attempt to bill for Internet use could become a case of self-fulfilling prophecy: the very act of collecting the necessary information could raise the network's operating cost to the point that users will have to pay more. Anthony Rutkowski, executive director of the Internet Society and a former vice-president at Sprint Telecommunications, thinks "it won't be worth the trouble to account for users' consumption of the network's capacity."

Whether and how to devise a workable billing system if and when usage-based pricing arrives is a decision that will have to be made cooperatively by the companies that carry Internet traffic, along with the Internet Engineering Task Force—an organization with representatives from government, research and educational institutions, and vendors from all over the world that writes technical standards for the Internet.

A Changing Picture

The next few years will be a time of shakeout in the burgeoning Internet business. Because the Internet operates as a loose cluster of networks, no one is really "in charge," and each provider of local, regional, and backbone service is free to price Internet access any way it chooses—each, of course, influenced by the price charged by *its* access supplier.

The most likely short-term scenario is for flat-rate service to continue as the norm. In fact, the prevailing assumption is that the smartest way to do business will be to maintain the status quo. Online society has mushroomed on the basis of unlimited use, a structure that encourages a kind of freewheeling exploration. The companies that sell Internet access understand this appeal and seem loath to tamper with it. "We don't want to kill the goose that laid the golden egg," says MCI's Gross. He insists that MCI "will not unilaterally impose" usage-based pricing. "We're very content to operate in the current Internet mode" in the near term, he

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says, and expects to make no major changes in the next year or two. Eric Aupperle, president of Merit Network, the regional network serving Michigan, echoes this sentiment. "My sense is that the community wants flat-fee access," he says, "and that's how it's going to be."

One compromise pricing method is for an Internet customer to declare at the outset whether it will be a high-volume or low-volume user. For a given bandwidth, the Internet service provider could charge the low-volume user less than a high-volume user. That way a small company can get the benefit of an affordable, high-capacity access. MCI is looking to put something like this in place "in the very short term," says Gross.

The amount of change that end users will experience depends on the type of Internet service they have become accustomed to. Clients of Nearnet in the Northeast and of Barnet in California will feel barely a ripple during this transition. Those networks have been accepting commercial business for years, and so have relied less on NSF. But in other areas of the country, the regional networks have continued to depend heavily on NSF for funding. There, prices to universities and other organizations that hook into the regional network will probably rise.

Usage-based fees could defray operating costs and possibly relieve congestion and delays. But the idea of a ticking fare meter is anathema to Net culture.

Into the Marketplace

As federal funding for the Internet winds down, following it into extinction are the NSF's "acceptable use policies," which have restricted use of the Net for profit-making activity. As the Internet is reborn as a medium not just of public discourse but of commercial opportunity, the revenues generated by such activity might well render moot the questions of per-use charges and ensure access by nonprofit groups. Just as retail stores pay rent to occupy a shopping mall, companies that make a profit on the Net will pay telecommunications companies to be there. Microsoft is heading in this general direction with its plan to offer Internet access through Windows 95, the long-awaited version of its popular Windows software for personal computers. Microsoft will obtain its revenue not from consumers, who will pay the company only a nominal fee for Internet access, but from businesses that set up shop on the Net.

Commerce on the Internet is still embryonic. A few companies publish online catalogs, but transactions are still consummated by telephone and credit card and the product arrives in a UPS truck. But it is in the marketing of information-based products that the Internet's business potential can be more fully tapped. Software.Net, for example, delivers computer programs through the Net. Other companies are similarly gearing up to distribute music and digitized art online, according to Bob O'Keefe, a professor at Rensselaer Polytechnic Institute's School of Management. Commercial sponsorship also made possible "free" radio and television broadcast; following this model, advertising revenue could pay for on-line publications. Such advertising is potentially of more value than printed or broadcast ads to consumers, who can obtain precisely the product information they need with a few mouse clicks on an unobtrusive icon.

Although such moves may solve some pricing problems, the biggest hurdles to Internet access for many people are not fees for service but the cost of a computer. Commercial activity on the Net could help here, too. As a marketplace, the Internet can be subject to a process as old as the Net is modern: taxation. One suggestion, from David Farber of the University of Pennsylvania, is to impose a 10 percent sales tax on business conducted over the Internet. This revenue could create a pool of funds to buy Net terminals that would be distributed widely at libraries and community centers. Given the resistance to new taxes that now dominates the political landscape, however, such a scheme seems far-fetched.

While equity of access is far from guaranteed in the near term, the public should in the long run benefit as the Internet is released from the simultaneously nurturing and smothering federal sponsorship. Decades of government support have built a communications infrastructure that fosters experimentation. For the last eight or nine years, the NSF has been in the business of "market building," says NSFNet program officer David Staube—constructing an infrastructure and trying to persuade institutions and individuals to use it. That phase has passed. Now, he says, "the market can stand on its own—without our seed money."■

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An evolutionary perspective offers new insights about disease and why it persists.

When Bad Genes Happen to Good People

By Randolph M. Nesse

I take off my glasses and gaze at the suddenly blurry scene out my window. People walk by, but I can't recognize them. The leaves on the trees look as though they have been colored by a child with a thick green crayon. Like me, a full quarter of the population in modern societies is nearsighted. We get along fine today, but how would we have fared in the ancestral environment? Many of us would probably have survived as second-rate hunters and gatherers, but some would likely have become tiger food, and others would have slowly starved because we could not see our prey. By now, the genes that contribute to nearsightedness should have been strongly selected against. Yet somehow they have persisted.

Why do the genes that cause disease persist? Is natural selection so weak that it cannot eliminate the genes that contribute to nearsightedness, heart attacks, and cancer? This hardly seems likely for an evolutionary force that has shaped such exquisite and sturdy creations as the heart, the ear, and the eye. Furthermore, as geneticists have long shown, selection forces should rapidly eliminate genes that cause serious disease. If all members of a population have one copy of a recessive gene that is lethal when homozygous (that is, when two copies occur in the same person), that gene will, after just eight generations, be present in only 10 percent of the population. After 65 generations, the single copy of the gene will be present in less than 1 percent of the population, and the disease will affect only 1 out of every 10,000 people. Deleterious genes that are dominant—meaning that disease occurs in people with only one copy—are weeded out much faster. Natural selection is not weak—it eliminates most disease-causing genes far faster than they are created by mutation. How, then, can we explain their persistence?



Art by Joan Miró: *Ciphers and Constellations in Love with a Woman*, 1941

Proponents of a new approach called Darwinian medicine are trying to explain why these genes are so common as part of a broader quest to discover why our bodies aren't more reliable. The emerging answers yield a richer view of the human body. Increasingly, we are seeing the body less as a Platonic ideal and more as a bundle of evolutionary compromises. We are learning that our vulnerability to each disease is a trait that persists in the face of natural selection for very specific reasons. As biomedical researchers develop technologies for identifying and altering disease-causing genes, our understanding of these reasons clearly assumes a greatly enhanced practical importance.

Old Answers Are Inadequate

It is true, of course, that the genes that cause some abnormalities may persist because people with the abnormality have just as many children as other people. The genes that predispose a person to manic-depressive illness, for instance, may not decrease his or her reproductive success and could, according to some, even increase it. But what about disease that causes early death? Some have argued that the relative safety of modern life can explain the prevalence of many diseases because it weakens natural selection. To the extent that some forces of natural selection are now weaker, this has happened only extremely recently in evolutionary terms. Even genes that now have no effect on reproductive fitness will not, by chance, become common in just a few generations.

Another common supposition is that DNA replication is so inexact that new errors accumulate faster than natural selection can eliminate them. To be sure, some diseases do seem to be caused simply by mutations—new errors in the DNA code that arise as fast as natural selection eliminates them. In fact, there are thousands of unusual genetic diseases that are caused by rare recessive genes. Such genetic mistakes are difficult for natural selection to eliminate entirely. For instance, if 1 of every 100 people carry such a gene, then 1 in 10,000 will contract the disease, while if 1 in 1,000 people carries the gene, only 1 in 1,000,000 people will get the disease. As the gene becomes increasingly rare, the force of selection fades even faster, so natural selection cannot eliminate the gene completely. For diseases that affect fewer than 1 in 20,000 people, this may be a sufficient explanation. But when we turn to the more common genetic diseases, mutation does not occur often enough to outweigh the force of natural selection. Other explanations are necessary.

The simplest is that some genes are especially vulnerable to mutation. For instance, the gene that causes Duchenne's muscular dystrophy is damaged by mutation 10 to 100 times more frequently than most other genes, undoubtedly because it is huge—many times the length of the average gene, with some 2 million base pairs that take up almost 1 percent of the X chromosome (as compared with the typical gene, with closer to 1,000 base pairs.)

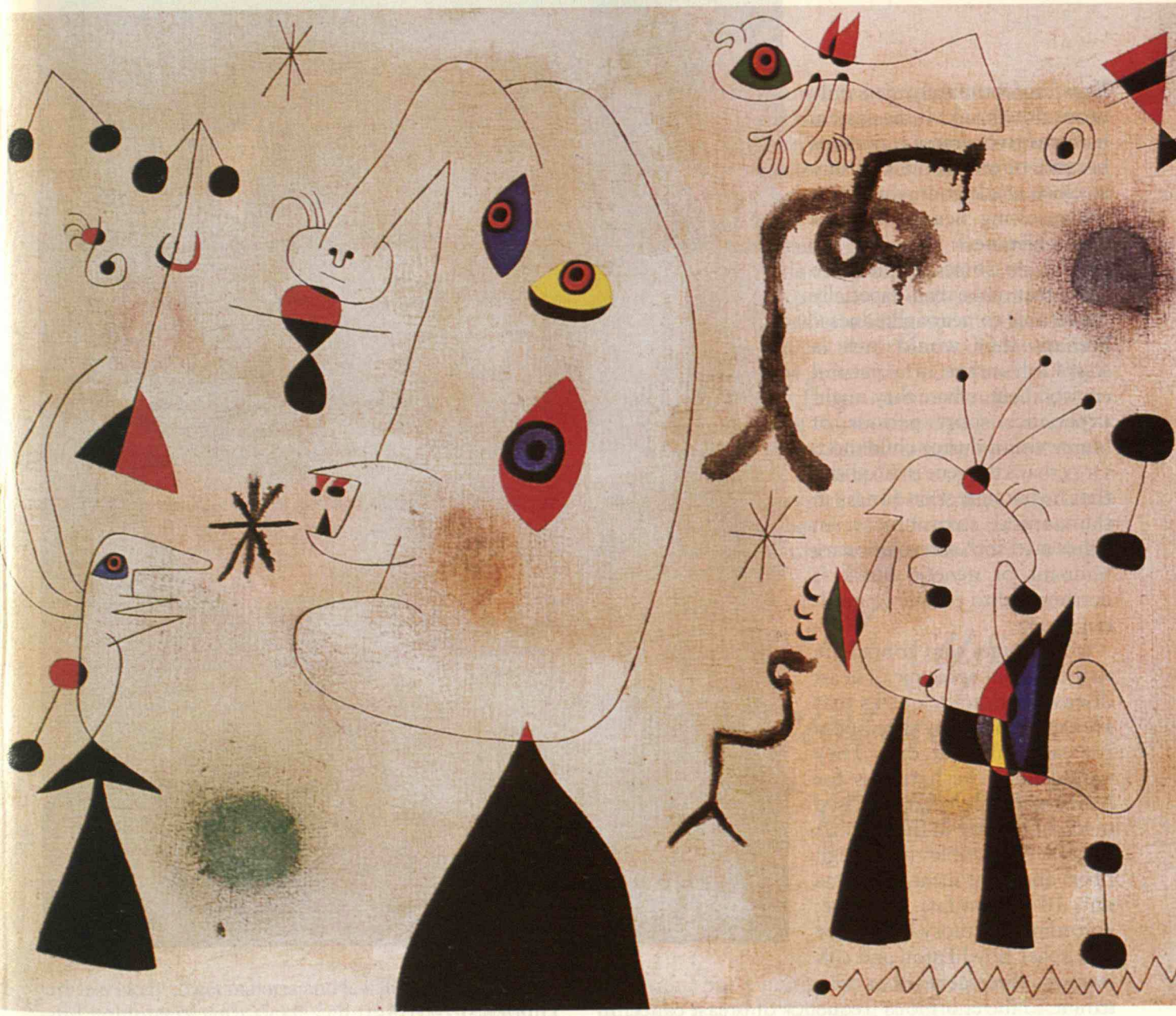
Nonetheless, new mutations cannot begin to explain the continuing prevalence of something as common and harmful as cystic fibrosis—a fatal hereditary respiratory disease that occurs in childhood. Quite simply, in trying to explain the persistence of disease, the old answers look less and less adequate.

Genetic Quirks

The genes that contribute to the bulk of modern human disease were not harmful in our ancestral environment. Some genes that cause atherosclerosis, or so-called hardening of the arteries, for instance, would be harmless if our diet was 15 percent fat instead of 40 percent. Because these genes were harmless, or even helpful, in our original environment, we call them "quirks" to remind us that they are not really deficits—that is, until they interact with altered environmental factors.

The genes that contribute to most modern disease were not harmful in the ancestral environment.

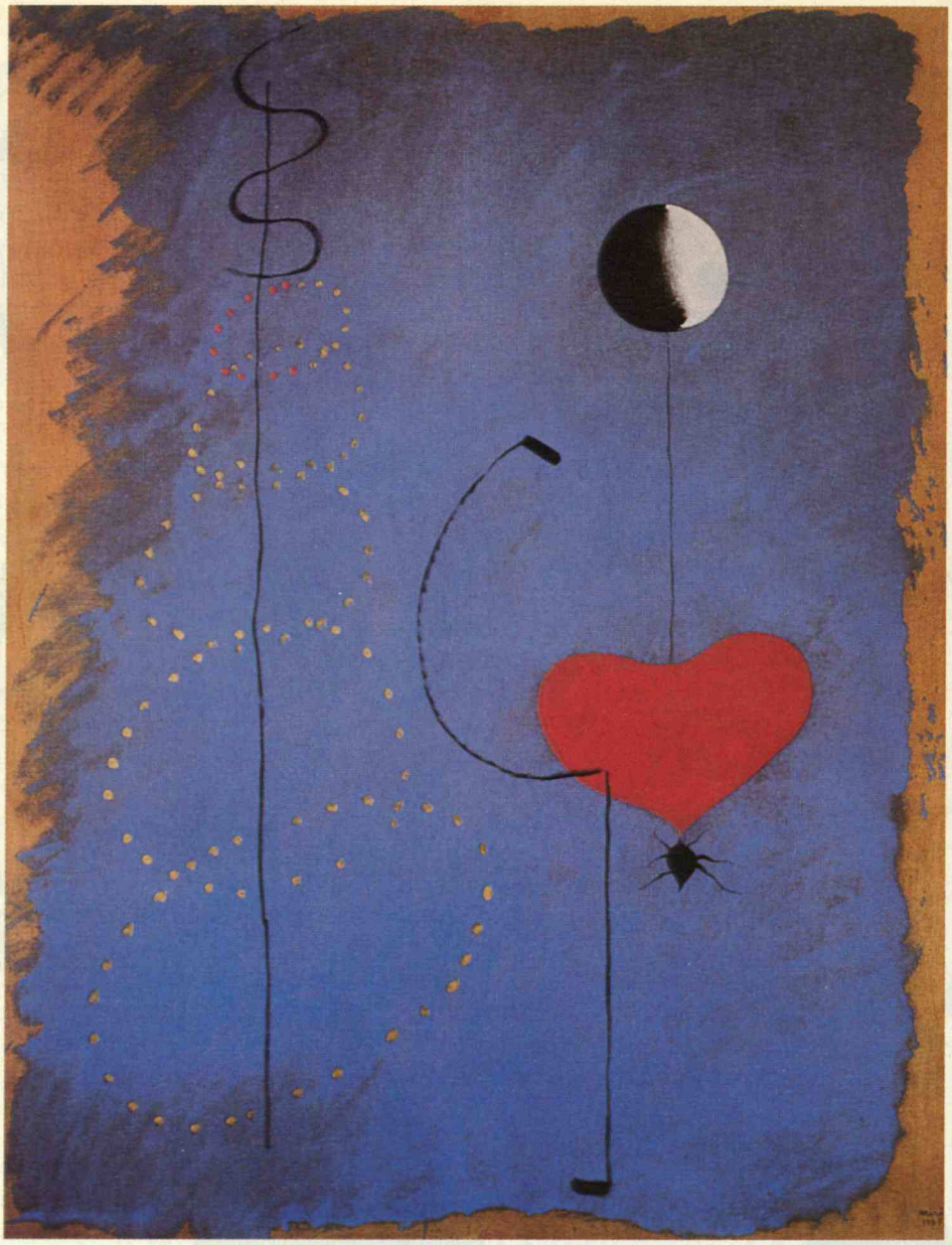
RANDOLPH M. NESSE teaches in the Department of Psychiatry at the University of Michigan. He is coauthor, with George Williams, of Why We Get Sick: The New Science of Darwinian Medicine *(Times Books, 1995).*



Nearsightedness (myopia), is a good example. It undoubtedly has a genetic component. According to a University of California study, the prevalence of myopia in late childhood is 12.2 percent if both parents are myopic, 8.2 percent if one parent is affected, and only 2.7 percent if neither parent is affected. Genes are not, however, the entire explanation. Nearsightedness was rare in Eskimos prior to this century, as it is in most hunter-gatherer populations today. But in the decades after Eskimo children began attending school, the rate of myopia quickly increased to the same 25 percent prevalence found in most modern societies. Myopia, it seems, is completely dependent upon both environmental and genetic factors. If you have the genes and go to school in childhood, you will almost certainly become myopic. But if you don't have the genes, school won't hurt your eyes, and if you don't go to school, the genes will cause no harm.

What exact environmental factors cause myopia? Investigations into the responsible mechanism reveal one of the wonders of the body. When researchers place cloudy lenses over the eyes of young chicks or monkeys, these animals' eyeballs keep growing longer until they are profoundly nearsighted. The exact mechanisms have yet to be completely understood, but it appears that natural selection has shaped a biological system that induces growth in the eye whenever the retinal image is blurry. This is useful indeed. The mechanism that automatically focuses slide projectors is similar, except, of course, that it can go back and forth.

Art by Joan Miró: *Personages, Birds, Stars*, 1946



Eyes, unfortunately, can only grow, not shrink. If the system happens to overshoot, perhaps because of unnatural exposure to close work at an early age, the resulting nearsightedness lasts a lifetime.

Why do some people have genes that make them especially vulnerable to nearsightedness? Perhaps they would have a slight advantage in a natural environment, where they might experience short periods of blurry vision during childhood. Or perhaps the gene is a "quirk" that has no effect on fitness in the natural environment. In either case, such an evolutionary remnant or genetic quirk is detrimental to people in modern society.

Many genes that contribute to the current epidemic of heart disease seem to be quirks that are dangerous only when people eat a high-fat diet. They would likely be harmless for hunter-gatherers who exercised much of the day in their efforts to gather vegetables (with high fiber) and hunt meat (that was only 10 percent fat). Likewise, according to Emory University researcher Boyd Eaton and colleagues, some genes that contribute to the enormous frequency of breast cancer in women in modern societies may have had few harmful effects in societies in which women became pregnant soon after puberty, breast-fed their babies for years, and then quickly became pregnant again.

Some adult-onset diabetes may be caused by genes that were once useful. Geneticist James Neel discovered that the Pima Indians in the Southwestern United States exhibit a marked tendency toward obesity and adult-onset diabetes—but only since they abandoned their traditional diet for a modern, Western one. Neel postulates that today's extraordinary incidence of adult-onset diabetes in this group—approaching 50 percent of the population over the age 35—could be due to the same "thrifty genotype" that stored calories and once conferred an advantage in an environment where famine was a strong force of selection.

Hidden Benefits

Genetic quirks that cause harm only in the modern environment make up just one category in a Darwinian framework. Sometimes continuing, but often hidden, benefits from the genes associated with a disease can help explain why these genes have persisted over the course of generations. The most widely recognized phenomena in this category are genes that may offer a so-called heterozygote advantage—an advantage, in other words, that occurs when a person has only one copy of a given gene where two are needed to cause disease.

Take, for instance, the case of sickle cell disease. Individuals who have two genes (homozygotes) for sickle cell hemoglobin (HbS) produce rigid, sickle-shaped cells that can clog small blood vessels. These individuals have episodes of terrible bone pain, and they die very young.

Art by Joan Miró: *Dancer*, 1925

It would seem that selection should eliminate a gene that so drastically decreases fitness, but it doesn't. Sickle cell disease affects 1 in every 500 African Americans in the United States, and 8 percent of the black population in the United States carries the gene.

An explanation for the prevalence of sickle cell disease was first suggested in 1949 by the great British biologist and evolutionist W.B.S. Haldane, who noted that the gene for HbS occurred in up to 14 percent of people in areas of Africa where malaria had been prevalent, and that the frequency of the gene, as plotted on a map of Africa, matched the frequency of malaria. He then wondered if heterozygotes (people with one normal hemoglobin gene and one for HbS) might be protected against malaria and thus have a higher fitness than either people with two versions of the gene for normal hemoglobin or those with two copies of HbS.

The evidence for this heterozygote advantage is now overwhelming. African individuals with sickle cell trait are less likely to get malaria and less likely to die from it, and volunteers with sickle cell trait who received a malaria inoculation became ill less often and had fewer complications than people with normal hemoglobin. When malaria is no longer present, selection tends to decrease the frequency of the HbS gene, as has already happened in the United States even in the short period since Africans first arrived.

Sickle cell trait has become the exemplar of a useful gene that also causes disease, and the phrase "heterozygote advantage" has become almost a synonym for explanations of the persistence of a gene that causes disease. In fact, however, the sickle cell case is somewhat unusual even as a case of heterozygote advantage. Its benefits are limited to certain locations (where malaria is prevalent). Also, it consists of a single mutation. Finally, this mutation seems to have arisen in only the past 10,000 years, probably, as anthropologist Frank Livingstone has documented through studies of agricultural methods and the frequency of malaria, because human slash-and-burn agricultural methods opened up bodies of stagnant water to the sunlight required by the species of mosquito that serves as the principal vector for malaria.

For other genetic causes of disease, the explanations become more complex and uncertain. Consider, for example, cystic fibrosis, a fatal disease that affects 1 out of every 2,500 newborns of European origin. Given this incidence, we can calculate that the disease-causing recessive gene must be present in 1 out of every 25 people from this group. This is an enormously high frequency for a gene that causes a fatal genetic disease—one that cannot be explained simply by mutations alone. There must be some benefit.

The recent discovery of the specific gene associated with cystic fibrosis has revealed further information. About 70 percent of cases are accounted for by a single mutation, but a myriad of other mutations can also cause the problem. According to Francis Collins, director of the Human Genome Project, the multiple variations suggest that they may have conferred some heterozygote advantage in the Northern European population. And, in fact, recent studies by Sherif Gabriel and colleagues at the University of North Carolina suggest that the cystic fibrosis gene may protect against death from cholera. When injected with cholera toxin, mice that have one copy of the gene have half as much diarrhea as ordinary mice, and mice with two copies of the gene do not get diarrhea.

The gene associated with cystic fibrosis may have persisted because it helps protect against death from cholera.

Many other genes need similar investigation to look for possible benefits. For instance, up to 10 percent of Ashkenazi Jews (from Eastern Europe) carry the gene for Tay-Sachs, a disease in which the lack of a particular enzyme (called hexosamidinase A) causes progressive neurological deterioration and death in childhood. Data

on infection rates and population distributions suggest that heterozygotes may have been protected against tuberculosis, a major force of selection in Ashkenazi Jews. Jared Diamond, a physiologist at the University of California at Los Angeles, further notes in a recent discussion in the journal *Nature* that this group is also especially vulnerable to two other congenital metabolic diseases called Gaucher and Nieman-Pick. All three diseases involve disruptions of the same class of enzymes, and this supports the possibility that all may be selected because of similar functions.

Geneticists have long held that if a disease is caused by multiple different versions of a gene, this strongly suggests that natural selection has played a role in maintaining the mutations. Geneticist Victor McKusick of Johns Hopkins School of Medicine made such a case in 1979 for Tay-Sachs, noting that if two or more versions for the Tay-Sachs mutation were discovered, it would be "a powerful argument for selection." Left to chance, McKusick and others explain, multiple versions would not be likely to rise to significant frequencies. In 1989, two distinct common mutations were found in patients with Tay-Sachs disease. In the case of Gaucher's disease, five common mutations account for almost all the cases. With these important clues in hand, we now need to investigate further the selection force—perhaps resistance to tuberculosis—that has maintained these genes in Ashkenazi Jews.

Some genes may fail to die out because even though they harm men, they benefit women—or vice versa.

Genes That Both Harm and Benefit the Bearer

For practitioners of Darwinian medicine, the picture becomes significantly more complex with the important realization that some genes harm the same person they benefit. Such an understanding is often lost in the common misperception that an individual gene serves only a single purpose. The fact is that many genes are well known to be pleiotropic—that is, to have multiple effects. If one of the effects of a pleiotropic gene is beneficial, then the gene may be selected for despite its other harmful effects.

Some of the best examples may be some genes related to aging. In a theoretical, but nonetheless classic, example offered in 1957, biologist George Williams noted that a gene causing calcium to be deposited in the arteries might be selected for if it also caused bones to heal more quickly. Because every population has more young people than old, the force of selection is stronger earlier in life, and a small benefit in youth can thus outweigh a substantial or even fatal harm late in life.

Physiologist Jared Diamond has proposed an explanation for some diabetes that may depend on this mechanism. A gene called DR3 has been shown to be very common in children with diabetes. If one copy of the gene is present in only one parent, one-half of the offspring should have the gene. But the observed rate is close to two-thirds, ostensibly defying the laws of genetics. Diamond explains this discrepancy by noting that as many as eight out of ten conceptions routinely end in miscarriages, many of which are never noticed. The DR3 gene in a fetus, he postulates, may greatly decrease the miscarriage rate and thus perpetuate itself despite causing severe diabetes. If confirmed, this will perhaps be the ultimate example of a pleiotropic gene that is selected because of benefits early in life despite the fact that it causes severe problems later.

A genetic tendency to gout, a painful joint disease, may arise in a converse manner. Gout is caused by precipitation of uric acid crystals in the joint fluid. Researchers have observed that the blood levels of uric acid in a wide variety of species are directly related to the species' life span. While the mechanisms are still ill-understood, many believe that uric acid's function as an antioxidant may prevent some effects of aging. We humans, with our long life-span, have higher levels of uric acid than other species—so high that gout some-

times results. An evolutionary perspective suggests that the genes that cause these high uric acid levels persist because they give most of us longer lives.

Sexual Antagonists and Outlaws

A full accounting of the evolutionary forces that maintain the frequencies of genes that cause disease must also take several other factors into account. For one thing, some genes that benefit women may harm men, and vice versa. Hemochromatosis, for instance, a metabolic disease leading to liver damage and diabetes, is caused by a recessive gene that vastly increases the efficiency of absorption of iron from the gut. The excess iron damages men's livers by middle age, but women need more iron to compensate for the blood they lose with each menstrual period and thus often show no symptoms until late in life. So far, we don't know why this disease persists, but it is quite possible that the ability to absorb extra iron during the reproductive period confers an evolutionary benefit to women who carry this gene.

Oxford geneticist David Haig has recently investigated the possibility that the divergent genetic interests



Art by Joan Miró: *Dragon with Red Tipped Wings in Pursuit of a Serpent Spiraling Toward a Comet*, 1951



of men and women may have shaped several subtle yet powerful genetic competitions that cause disease during pregnancy. He begins with the observation that the optimal size of a baby that will maximize a female's genetic interests is smaller than that for her mate. This is not so much because of the dangers of bearing a large offspring, but because the female maximizes her reproductive success by reserving some nutritional resources for her next offspring, while the male gets no benefit from such farsightedness, because his mate's next offspring may not be his.

Haig has found another powerful example of this sort of conflict in mice. Insulin-like growth factor II (IGF II) is secreted by the placenta and makes the baby bigger. If the gene is missing, the offspring will be 40 percent smaller but otherwise normal. The gene that makes this factor is active only if it comes from the father. The same gene, if it is transmitted to the fetus from the mother, is "imprinted," that is, chemically changed in a way that makes it inactive in that generation so her own IGF II gene will not make her offspring larger than is in her interests.

When an active copy of the gene comes from the father, how does the mother defend herself against its effects? She has another gene that makes another substance, insulin-like growth factor receptor (IGFr), which speeds the degradation of IGF II, thus making her offspring smaller. The gene that makes IGFr is, sure enough, imprinted in the opposite way from IGF II. It is inactive if it comes from the father, just what you would expect from a gene that represents the mother's interests in the conflict fathers and mothers wage over the optimal offspring size. So far, this battle has been confirmed only in mice, but something similar may well occur in humans.

Despite benefits that may be conferred disproportionately between men and women, genes in a given individual usually cooperate to create a body that will manage to insert copies of themselves into future generations. It is useful, however, to note that certain genes advance their own interests even at the expense of the individual. The best known of several examples is the so-called T locus on chromosome 17 in mice. Male mice with two copies of this gene always die very young, but about 25 percent of wild mice carry this genetic trait. The males carrying the trait (the heterozygotes) have a reproductive advantage: the gene impairs the ability of sperm with a normal chromosome 17 to fertilize eggs, so the trait becomes preferentially transmitted. Consequently, the proportion of heterozygous males' offspring that carry the gene is not the expected 50 percent but almost 90 percent. This increased transmission of the gene more than makes up for the severe decreases in individual fitness.

There is little question that many genes that cause disease are selected for because of their benefits to the individual, to other individuals who carry the gene in different combinations or environments, or even because of benefits to the gene itself. Can such evolutionary insights offer practical help to medical practitioners in treating disease? Today's technology is closing in on the sequence of the entire human genome. This information will doubtless provide a wellspring for future study of human biology and for cures of diseases that were thought incurable. But the study of evolutionary influences on disease reveals our bodies as rich and interwoven biological systems. This perspective suggests a cautious approach to human gene therapy. For example, a full knowledge of the pleiotropic functions of the gene associated with cystic fibrosis—such as the protection it may confer against cholera—may someday give us enough confidence to eliminate it so long as cholera is controlled. But before we alter other genes, such as those that cause aging, we will certainly want to know the evolutionary forces that sustain them. By studying such evolutionary links, Darwinian medicine can offer important clues to some of the biological mechanisms that cause disease—clues that could well accelerate new kinds of treatments for disparate diseases as well as helping to protect us from ill-considered interventions. ■

Art by Joan Miró: *Spanish Dancer*, 1945

MITnews

FROM THE ASSOCIATION OF ALUMNI AND ALUMNAE OF MIT MAY/JUNE 1995

U.S. News & World Report Rankings

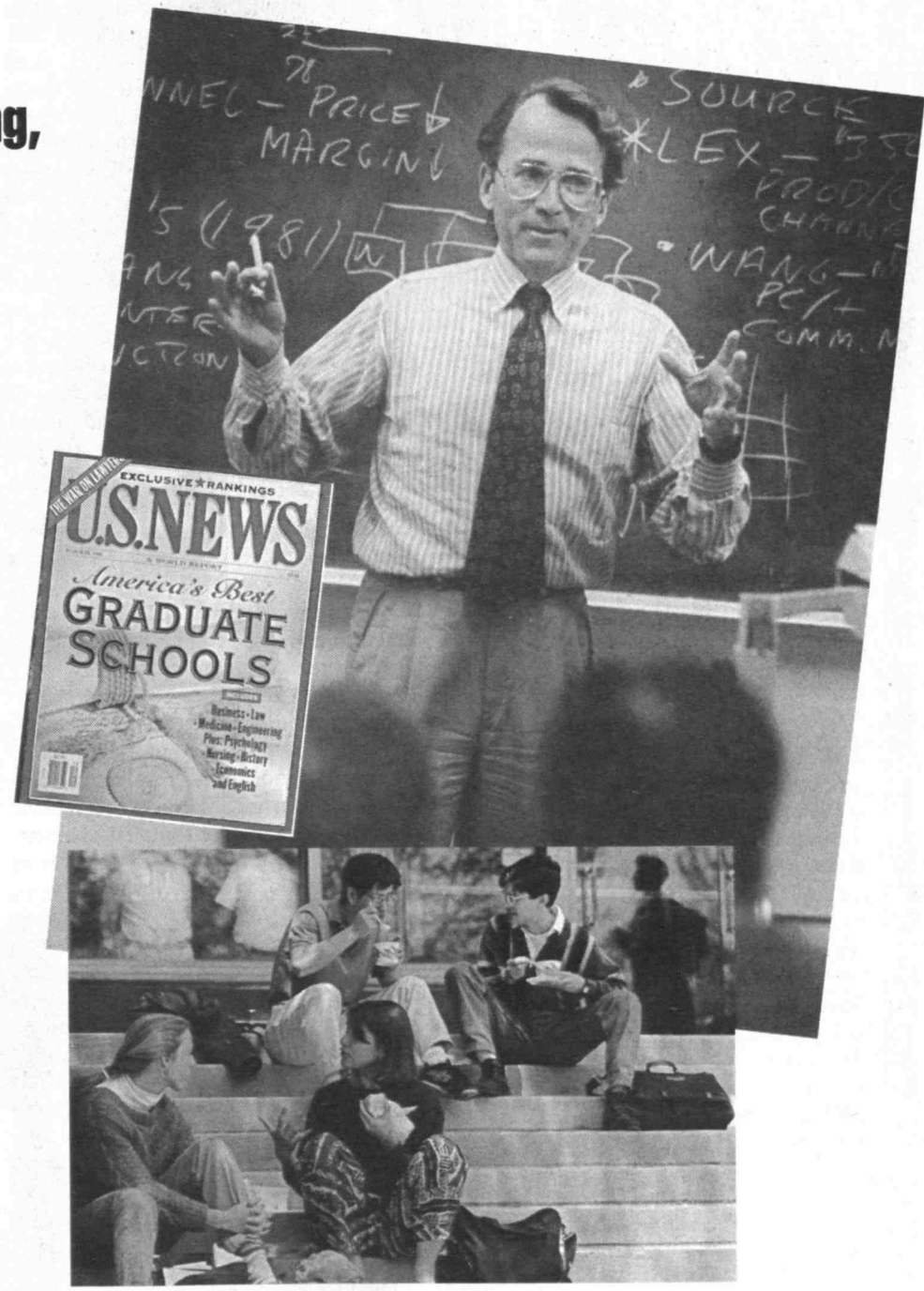
Engineering, Sloan, & Economics Tops

In the latest ratings of graduate programs by *U.S. News & World Report*, the MIT Sloan School of Management climbed to No. 1 for the first time. For the sixth straight year, the School of Engineering ranked No. 1, making this the first year in which a single university has placed at the top in both engineering and management. Also announced in the March 20 issue of the magazine, the Department of Economics tied for first place with departments at four other universities.

Addressing a news conference in the lobby of the Sloan School on the day of the announcement, surrounded by jubilant students, President Charles Vest remarked on the significance of the joint recognition of MIT's programs in management and engineering, "two fields critical to the creation of jobs and the development of a strong economy." Vest noted that "success in business depends on innovation, and in today's world, innovation depends on technology."

Sloan School Dean Glen Urban also commented on the "extraordinarily creative and relevant environment for a business school" provided by MIT's "leadership in science and technology, its long history of close cooperation with industry, and its track record as a breeding ground for entrepreneurs."

Elite business schools were tightly grouped at the top of the listings. The



Above: Glen Urban, dean of the Sloan School, on whose watch the school's rating—which had been climbing for years—hit No. 1. The rating can only add luster to the degrees being earned by these Sloan students.

PHOTOS: MICHEAL LUTCH

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Public Opinion Matters

In the April **MITnews**, *we reprinted an article about MIT from the* Boston Globe Magazine. *In this issue, we devote pages to the* U.S. News & World Report *ratings of graduate schools and to the Coopers & Lybrand survey of industry/university relations. If you think you detect a trend toward paying more attention to indicators of public opinion here, you are correct. It is no longer enough—if, indeed, it ever was—to stay in our laboratories and classrooms, doing teaching and research we know is first rate. If the Institute expects to earn support, both popular and financial, from alumni/ae and the families of our students, from federal and state government, and from industry, it must be aware of, responsive to, and aggressively shaping the way it is perceived by all those constituencies. We trust that* **MITnews** *can help alumni/ae to be informed participants in that process.*

—Susan Lewis

Engineering, Sloan, & Economics *Tops*

continued

University of Pennsylvania's Wharton School came in second with a score of 99.8, only .02 behind MIT. Stanford scored 99.4, and Harvard, down from third place in 1994 to fourth place this year, scored 99.3. The nation's 281 accredited MBA programs were ranked in four categories: *student selectivity* (GMAT scores and undergraduate grade-point averages of the entering class, plus the ratio of applications to acceptances); *placement success* (proportion of graduates employed immediately after and three months after graduation, starting salaries, and the ratio of the numbers of on-campus recruiters to 1994 graduates); *reputation* (determined by surveying graduate school deans, MBA program directors, and close to 1,780 corporate recruiters); and *overall rank* (a composite of all of the above), with the top rating considered 100 percent.

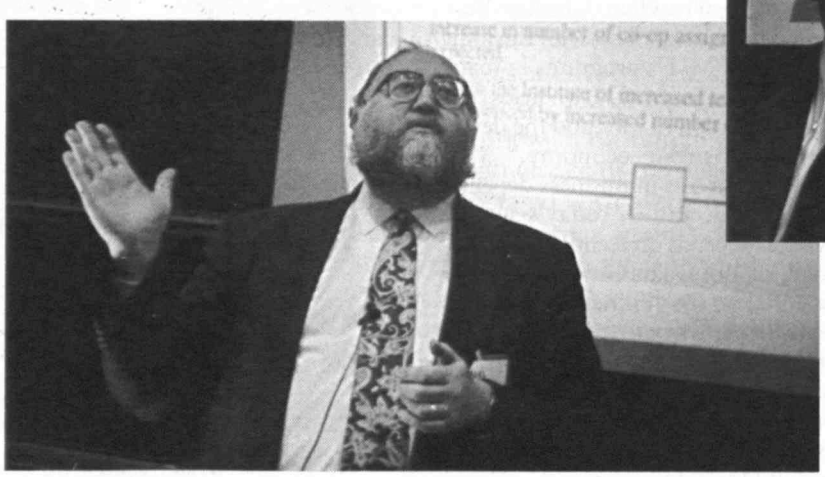
Particular management specialities were also ranked by business school administrators, and MIT topped the lists in management information systems and operations management. It also ranked high on real estate and finance.

Research volume, an important element in the ranking of engineering schools, is not included in the survey of business schools. It is, however, a valuable part of what Sloan has to offer, the dean believes. More than 100 companies sponsor close to $12 million in research annually at Sloan, believed to be more than any other U.S. business school. Urban cites research as a source of ideas and insights that serve both the students educated in this environment and the companies for which they will work.

The Sloan celebration that greeted the *U.S.News* announcement acknowledged something more than a pat on the back. Sloan, with 513 two-year master's students in management, as compared with 1,600 at Harvard and 1,400 at the University of Chicago, for example, has not had the name recognition of the larger schools. But surveys can help level the playing field: many at Sloan believe that last year's move up to No. 2 in the *U.S.News* rankings contributed to the increase in MIT's "yield rate" for the master's program (the percentage of accepted students who actually enroll), which went from 67 percent in 1993 to 75 percent in 1994, and to the one-third increase in applications over last year.

Glen Urban, who has been in the dean's office only 19 months, is quick to point out that the school owes much of its present position to the work of his predecessors. There is still plenty for him to do, however, if Sloan is to achieve its stated goal to become the world's "preeminent management school"





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by the year 2000, and Urban's expertise in marketing will be important. An emphasis on marketing can be seen in the new post of director of communications, to convey Sloan's message more effectively to industry, the public, and to the school's 16,000 alumni/ae.

Construction is underway on the Tang Center for Management Education, a 42,000-square-foot facility scheduled to be completed this fall.



Having his picture in U.S. News & World Report *as dean of the nation's No. 1 engineering school is something of an annual routine for Joel Moses (far left). One of six specialities in which deans and department heads nationwide ranked MIT at the top is civil engineering, taught at MIT in the Department of Civil and Environmental Engineering, headed by Raphael Bras, '72 (glasses and mustache). The rating acknowledges not only the teaching and research of the department's faculty (such as the aquatic science group, including [l. to r.] Professors Sallie Chisholm, Harold Hemond, PhD '77, Philip Gschwend, and William Thilly, '67), but also the calibre of students (such as graduate student Rebecca Zavistoski, '92, shown using laser doppler volocimetry to study turbulence).*

The Tang Center will enable Sloan to respond to both student and recruiter demand by increasing enrollment in master's programs by 33 percent, from 513 this year to 680 by fall 1996. Overall, enrollment is expected to grow to 1,330 students, including Leaders for Manufacturing and Sloan Fellows, Senior Executives, undergraduate majors, and 230 "full-time equivalents"—undergraduates from other schools at MIT who enroll in management subjects.

The dean notes the school's success at strengthening its programs and at the same time helping MIT curb costs: Sloan revised and shortened the core master's program, developed specialized tracks in areas such as financial engineering and new-product and venture development, increased teaching loads and the number of teaching periods in a day, and pared down the number of small classes (by offering small-draw classes in alternate years, for example). Once the new enrollment targets are filled, the school will be teaching 12 percent more students while improving "customer satisfaction," says Urban, with no increase in faculty or support staff.

President Vest remarked of the rankings that "we never get to the end of that road." No matter how well MIT does, there is always more to be done. Certainly the School of Engineering is Exhibit A: With the No. 1 rating overall and No. 1 ratings in six engineering specialities (mechanical, civil, nuclear, materials, chemical, and aero-

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Engineering, Sloan, & Economics *Tops*

continued



space engineering), the school is nonetheless focused on a new five-year plan and on program initiatives. In fact, within days of the *U.S. News* announcement, a new minor program in biomedical engineering was presented at the MIT faculty meeting.

The rankings for the nation's 219 graduate programs in engineering were based on five categories: *student selectivity* (average scores on the quantitative and analytical parts of the GRE, and the proportion of applicants accepted); *faculty resources* (the ratio of full-time graduate students to full-time faculty, the proportions of faculty holding PhDs and graduate students pursuing PhDs, and the number of doctoral degrees granted in 1994); *research activity* (1994 dollar total of funded research and that number divided by the number of research faculty), reputation (surveys of engineering school deans and academic deans and of 900 engineers, mainly from the National Academy of Engineering); and *overall* rank, based on all of the above, with the highest score considered 100 percent.

In an interview with Engineering Dean Joel Moses, PhD '67, *U.S. News* focused on efforts within the school to move engineers beyond mathema-

Above, from right: Franklin Quan, a research assistant in the Leaders for Manufacturing Program, and LFM graduate William Fonte, SM '94, discuss the fine points of truck axles with managers from GM'S Pontiac East Assembly Plant. Often praised as a prime example of the synergy that is possible on a campus where both engineering and management are first-rate, LFM is a partnership between Sloan, the School of Engineering, and major industrial partners to develop leaders and improve practice in world-class manufacturing.

PHOTOS: RICHARD SANDLER

tics and science by placing more emphasis on design, manufacturing, and environmental issues—what Moses refers to as "Engineering with a big 'E.'" The centerpiece of that effort is a series of practice-oriented master's degrees that are completed in only one year—half the time required for the research-oriented degree. These programs are or soon will be offered in the Departments of Electrical Engineering and Computer Science, Civil and Environmental Engineering, and Aeronautics and Astronautics.

Meeting with *Technology Review* a few days after the ratings hit the newsstands, Dean Moses had other concerns foremost in his mind. He had just returned from chairing a conference of engineering deans in Washington, where talk was of the alarming scenario in research funding. Once-vigorous research programs in industry have been gutted in recent years, says Moses, and even if companies compensate by contracting for more university research, the closing of industrial laboratories is cause for concern. But now there is also talk in Congress of cutting federal support for engineering research by as much as half, and if that happens, Moses says, it would be a crisis for research-based institutions.

"The innovation cycle in this country is being undermined," he says, when there is inadequate research to generate the new products of the coming decades. Some 75 percent of engineering research funding presently comes from the federal government, Moses says, and if that role is cut substantially, there is no possibility that industry could pick up the slack. Those who advocate such cuts "have no idea what the impact would be," he believes.

Moses wanted to end the interview on a positive note, however, and, like Vest and Urban, he pointed to the ties between engineering and management as factors in past and future distinction on the part of both schools. The showcase collaboration is the Leaders for Manufacturing Program, a consortium of faculty in engineering and management plus major industrial partners, designed to improve manufacturing education, research, and practice. It offers students a two-year program leading to a master of science degree in management and in one of five engineering disciplines.

The two schools recently announced a new collaborative program in System Design and Management, a partnership between MIT, industry, and government that will enroll its first students this fall and be fully deployed by summer 1996. The SDM program is targeted at working engineers who will become project managers at companies that develop—and at government agencies that procure and integrate—advanced products and complex systems. Students will study everything from systems architecture to marketing, in both on- and off-campus settings.

Paul Joskow, chair of the Department of Economics, which tied with departments at Stanford, Harvard, Princeton, and the University of Chicago for the No. 1 rating, observed that it's always a pleasure to have "outsiders confirm your own perception."

The top graduate students and faculty in economics worldwide already know the calibre of the MIT department, Joskow said. He sees one of the chief functions of the *U.S. News* survey as internal—to remind the MIT community, which "is focused on science and engineering," of what an outstanding resource it has in its midst.

"Plenty of schools conduct outstanding [economics] research, but the teaching is not good," Joskow says, while MIT also offers the "best education in the world." He noted that all of the presidential economic advisers are MIT grads, including Council of Economic Advisors chair Laura D'Andrea Tyson, PhD '74. Some 550 students apply every year to the graduate program in economics, of whom MIT enrolls 25 or 30 students.

Economics has long been strong at MIT, said Joskow, and having undergone a recent departmental "renewal," it will stay strong. In the last three years, the department hired nine junior faculty and one senior faculty member. It will continue to emphasize the importance of public service, he said.

U.S. News rated academic departments such as economics by surveying department heads and directors of graduate studies at institutions that awarded five or more doctorates in that field of study since 1989. Such subjective ratings can generate "a lot of noise in the system," Joskow remarked, but he believes that "the rankings in economics are more or less right." □

—*Susan Lewis*



University/ Industry Links: The Ties That Pay

A survey released early this year by the financial services firm Coopers & Lybrand showed that fast-growth companies that avail themselves of university resources have productivity rates almost two-thirds higher than growth companies that don't make university connections.

Coopers & Lybrand's "Trendsetter Barometer" interviewed CEOs of 424 product and service companies identified as the fastest growing U.S. businesses over the last five years, companies that ranged in size from aproximately $1 million to $50 million in sales. It found that only four in ten of these companies

make use of campus resources such as training and recruitment or cooperative research and development; but the companies that do, boast productivity rates 59 percent higher than their peers who do not. Other positive indicators: the active group had 21 percent higher projected annual revenues, 32 percent more recent bank loans, and 23 more major capital investments planned in the next 12 months, the survey found.

The most frequently tapped university resource is students: 70 percent of the companies with university links hire student interns, and 40 percent recruit employees among students and new grads. More than one-third of these growth companies send their own employees to nearby campuses for training. More than four in ten said that they employ faculty as technical resources, while only 17 percent use faculty to help with business planning and 13 percent use faculty to advise on manufacturing technology.

Of the linked firms, 29 percent are involved in cooperative research and development, 20 percent use university laboratories or equipment, and 5 percent license a technology developed in a university lab.

Although the numbers show increased productivity among university collaborators, all is not sweetness and light. The study found (and MIT grads attending the Alumni/ae Leadership Conference session on university-industry links last September corroborated) that there are problems. Companies reported encountering unsupportive faculty culture and administrations, as well as a general lack of understanding of the industry point of view on the part of universities. In fact, only 29 percent of the growth companies with a university relationship would describe it as "extremely useful" to their company's growth.

The existence of stumbling blocks apparently doesn't discourage George Auxier, national director of entrepreneurial advisory services for Coopers & Lybrand. He says that reports of problems just show that there is more work to be done. "Only by overcoming the barriers to successful relationships can growth companies and their university collaborators reach the full potential of such partnerships," Auxier said.

"Overcoming barriers" is

letter

WHY STUDY BIOLOGY AT MIT

Richard Anthony's account of the Biology Department's development as a leading center in molecular and cellular biology was excellent (TR Nov/Dec 1994). As one of Irwin Sizer's graduate students immediately after World War II, I found it particularly gratifying to see that the article acknowledged his many contributions and his leadership of the department's transformation.

Anthony's essay also brought to mind the pre-1942 history of the department—as I understand it. Among the achievements of Karl Taylor Compton's presidency (1930–49), which was marked by efforts to strengthen the science departments, was the reorganization of the undergraduate biology curriculum. A five-year major in what was labeled "quantitative biology" was created that included intensive course work in chemistry and mathematics along with classical, descriptive biology.

It was this unusual curriculum that prompted me to enroll at MIT for both my undergraduate and graduate education, a double decision I have never had cause to regret. (When I was investigating graduate programs, after the war, I discovered that almost any other institution would have required me to take several years of course work in descriptive biology before I could qualify as a PhD candidate. MIT did not—although I was surprised at the doctoral oral exam when one of the "classical biology" professors on my committee asked how one could determine the sex of a spider. More surprisingly, I was able to come up with the answer: the male spider has an observable sac on one claw through which he deposits sperm.)

Having spent most of my career in management positions (e.g., vice-president for R&D at three Fortune 500 companies and director of the Space Sciences Research Center at the University of Missouri), I look back in admiration at MIT's collective wisdom in appointing Dr. Sizer as department head. His breadth of interests, vision, and interpersonal skills were exactly those needed to attract Salvatore Luria and other strong researchers and ensure that the department developed into the leading center it is today.

WARD J. HAAS, '43, PHD '49
FAIRFIELD, CONN.

also a concern for MIT's Office of Corporate Re-lations, which conducted its own study of industrial needs during 1994 and (through the Industrial Liaison Program) sponsored a conference on "New Models in University-Industry Partnerships" in April. Tom Moebus, director of corporate relations, notes that MIT program leaders are responding to the tough business climate by focusing more on the shorter-term technical and educational requirements of industry, for example, and taking more of a marketplace approach to building partnerships. □

Tuition to Increase 4.5 % for 1995-96

MIT announced in March a 4.5 percent increase in tuition—the lowest in 25 years—for the 1995–96 academic year. This will raise tuition to $21,000, a $900 increase from this year. The increase in room and board will average 3.3 percent, putting the overall cost for tuition, room, and board at $27,150—up from $26,075 this year.

The increases, approved by the MIT trustees, were announced by President Charles M. Vest, who said it was important that tuition at MIT, while reflecting the realities of the economy, "should increase only moderately." He noted that the need to keep an MIT education both excellent and affordable is an important driver behind the Institute's current reengineering effort.

By slowing tuition's rate of growth and making financial aid available, MIT remains accessible to bright students regardless of their family income, Vest said. This year, about 57 percent of MIT's 4,472 undergraduates receive financial aid packages comprised of scholarships, loans, and term-time jobs. The average aid for a needy student this year is $19,750—98 percent of tuition.

The Institute's "self-help level"—the amount students are expected to provide from loans and term-time jobs before receiving scholarship assistance—will be raised next year by $500 to $8,150, a 6.5 percent increase. MIT eases that burden somewhat by maintaining a campus minimum wage of $6.75 per hour and reducing the self-help requirements for students from families of very low income by as much as $3,500.

Responding to a question from Venkatesh Satish of *The Tech* regarding MIT's already high tuition and self-help levels, President Vest noted that the vast majority of MIT students major in engineering or science, fields in which the costs for facilities, computers and other infrastructure, and faculty salaries are highest. "Frankly, it is amazing that we can keep our tuition at a level comparable to most other world-class universities," Vest said.

In his interview with Satish, Vest reaffirmed the Institute's commitment to need-blind admissions. The cost of maintaining that commitment, however, keeps climbing, particularly in the face of "the continued retreat in providing financial aid" on the part of the federal government. "Just a decade ago, the federal government funded nearly half of our student scholarships," Vest said. "They now fund less than 10 percent." In 1994–95, MIT students received a total of $34.5 million in grants from all sources, of which $27.7 million was provided from Institute funds.

Since a number of students who do not qualify for financial aid administered by MIT, which is based solely on need, still receive scholarships from outside sources, it is estimated that only about 29 percent of students and/or their parents pay the full annual cost.□





New Director, New Era for the Enterprise Forum

The MIT Enterprise Forum, founded 15 years ago by alumni/ae in Cambridge and New York City, has a new director—and a fresh infusion of energy. Kathleen Hagan, an entrepreneur with extensive experience in global marketing, management, and government affairs, took over as the executive director of the Forum in December. She immediately embarked on an ambitious schedule of acquainting herself with the personalities, programs, and priorities of MIT and the 18 branches of the Forum worldwide. Her aim is to assess the present level of services and develop plans to meet her twin mandates of making the Forum less dependent on the Alumni/ae Association's financial support while providing invigorated leadership for existing and new Forum chapters.

The Forum has traditionally offered case-study presentations, workshops, seminars, and other activities that deliver the counsel of experienced entrepreneurs to start-up companies and growing businesses, particularly in high tech. Forums now exist in 14 U.S. cities,

New Director, New Era *continued*



as well as in Mexico City, Tel Aviv, Toronto, and (the newest Forum) Taipei.

Hagan joined the staff of Massachusetts Senator Edward Brooke in 1971, less than two years after completing a BA at Trinity College, Washington. By the time she moved on in 1979, she had risen to the rank of executive assistant and director of Brooke's Massachusetts office, and she had acquired a thorough grounding in the legislative, regulatory, environmental, and other elements of the federal government's relationship with business.

From there, Hagan went to the Massachusetts Port Authority, a quasi-public corporation that owns and operates Logan Airport, the Port of Boston, and the World Trade Center. As the director of foreign trade, she had a two-part job: marketing the aviation and maritime services of the Port Authority, which is in competition with centers like New York City and Montreal, and running a trade-promotion program that encouraged foreign sales by New England companies. While in this post, she earned an MBA from Boston University.

She loved the work, she says, "but there were more things that I wanted to do." So in 1987, she established an international marketing consulting practice, Hagan & Co. "Half of our clients were U.S. firms, primarily high-tech New England companies; we helped them sell overseas, set up distribution, find buyers, and gather competitor intelligence," she reports. "The other half were foreign companies that needed help with market assessment, market entry, or setting up joint ventures with U.S. firms." Her client projects ranged from negotiating cross-licensing agreements between a U.S. biopesticide firm and an Australian science agency, to conducting market-entry studies for a dozen Irish software firms.

Managing a successful consulting practice and teaching in the MBA program at Northeastern University were sources of enormous satisfaction, she says. Thus when William J. Hecht, '61, Alumni/ae Association executive vice-president, offered her the Enterprise Forum post, it was difficult to leave her business behind. "I was brought up to be a nurse, a teacher, or somebody's mother," Hagan says, "so it was a great victory for me to prove myself as an entrepreneur." But she found herself thinking, "I can always recreate Hagan & Co.; I can't always go to MIT." This job would give her a chance to put her background in government, international business, and entrepreneurship into play in an arena where she could leverage her skills into making a bigger and broader contribution.

"Now it seems perfectly natural to be here," she says, "because I have worked with technology, technologists, and MIT grads all my life." Indeed, Richard Heitman, '52, was on the board of Hagan & Co. from its inception.

"I have three key objectives," Hagan says. "One is to work with the chapters and create a greater sense of unity among them," using communications technology to create a virtual educational organization. "Second is to involve the Forum in meaningful ways in the programs and strategies of the Institute. And third is to build on the support and loyalty we enjoy from foundations, corporate sponsors, and entrepreneurs, so that we can perfect what we now do well and expand."

That the Board of Directors of the Alumni/ae Association wants the Forum to be more financially self-sufficient makes perfect sense to Hagan. "What happened to the corporate sector in this country in the 1980s—the downsizing, the reengineering—is happening in the university sector in the 1990s," she says. "The economics of delivering educational programs are changing, and the world in which universities operate, both in terms of their corporate relations and their federal funding, is changing." Money is tight across all programs, in all institutions.

When Hagan conducts her classes in global marketing for MBA students, she tries to use up-to-the-minute case studies. Tight budgets notwithstanding, she intends the Forum itself to be an up-to-the-minute case study as well.□

—*Susan Lewis*

A LETTER FROM
GARY SCHWEIKHARDT SM '73

GETTING THINGS DONE

It seems like only yesterday that I wrote my first President's Letter for *Technology Review*. By the time you receive this issue of the magazine, however, we will be close to the end of another "Alumni/ae Association year," close to the date when Karen Arenson, '70, will assume the presidency. It's a good time for me to report on what we've accomplished and what remains to be done.

Our focus during the year has been on continuing to operate a strong Alumni/ae Fund and to provide traditional services to our constituents while implementing the strategic plan developed under the direction of my immediate predecessors, Bob Muh, '59, and Dick Jacobs, '56. (*Dick discussed the strategic plan in some detail in his letter in the August/September 1994 issue of the* Review.) The Association staff and volunteers have done an excellent job on all counts.

Traditional programs, such as reunions, class and department-based activities, services to graduate-only alums, travel, Technology Day, the Alumni/ae Leadership Conference (ALC), and regional clubs have been strong and have attracted excellent participation. Case in point was the record attendance at and positive response to the September '94 ALC, which focused on the interface between industry and the universities.

At the same time, major changes were underway with regard to implementing the strategic planning recommendations. That things moved so smoothly on both fronts is a tribute to our excellent volunteers and to the staff, who labor under the able direction of Executive Vice-President Bill Hecht, '61, and Joe Collins, HM*, director of the Alumni/ae Fund and director of operations.

Joe's role as director of operations was created as part of a significant restructing of the staff organization that

* *"HM" indicates an honorary member of the Association.*

One of the areas of the where the Association will implement change the fastest is likely to be in online services, a response to both advancing technology and accelerating demand.

Bill and Joe introduced early in 1995. Joe was given responsibility for most of the day-to-day administration. Other staff members assumed new responsibilities for traditional programs and for new initiatives—the latter, notably, launched without any additional staff. What I find really exciting is the entrepreneurial character of the staff assignments to create new services—services, by the way, that respond to needs identified in a survey of alumni/ae that was carried out by an outside consultant in conjunction with the strategic plan.

New initiatives include better support for career planning, continuing education, and online communications among alumni/ae and between alumni/ae and the Association and the Institute. The career planning initiative, under the direction of Janet Serman, will build on services already offered through MIT's Office of Career Services and the Association's ProNet, but will also acknowledge the altered market and career patterns of the 1990s.

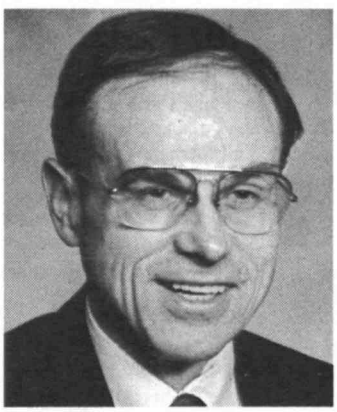
Eliza Dame has the responsibility for developing new offerings in continuing education that will hitch lifetime learning to the engine of MIT's undergraduate and graduate educational programs.

One of the fastest-moving areas of innovation—driven both by advancing technology and accelerating demand from our constituents—is online services. This spring, the Alumni/ae Association expects to have a "homepage" on the World Wide Web, just one (early) manifestation of the Association's commitment to electronic accessibility. This effort is under the direction of Diana Strange.

To keep a large staff focused on and informed about enhanced services, the restructuring included creation of an Operations Group—a management team comprised of representatives of all branches of the staff—and an enlarged staff newsletter. Although these steps are internal to the organization, they should manifest themselves in greater responsiveness to alumni/ae.

On the volunteer side of the house, the Association Board of Directors has implemented a new system of periodic reporting from members who represent specific geographical regions. At alternate meetings, members report on clubs, branches of the MIT Enterprise Forum, and other activities in their districts. The reports provide feedback for staff on program effectiveness, as well as inspire other districts to try new ideas.

The Enterprise Forum moved into a particularly dynamic phase this year, when the Board of Directors hired Kathleen Hagan as the new national director. She takes over from founding director Paul Johnson. (*See a profile of Hagan on page MIT 7.*) An entrepreneur with experience in government, Hagan came to MIT after operating her own international marketing firm for



Gary Schweikhardt

five years. The Association Board of Directors is confidant that she will meet her goals of reducing the Forum's financial dependence on the Association and providing leadership for its 18 branches worldwide.

An enhanced relationship between the Association and Resource Development—two branches of MIT with responsibilities for fund raising—has already begun to bear fruit, in the form of a joint plan to convert the Association's huge alumni/ae database to a "client server" system serving the needs of both departments. In response to both Institute priorities and advancing technology, the original five-year schedule for the transition to client-server has been cut to two years.

During the last months of 1994 and the first months of this year, the *Technology Review* Board and the Presidents' Committee of the Association Board have been conducting an extensive analysis of the *Review*'s financial picture. Editorially, the magazine continues to receive outstanding ratings from professional publishing groups and both alumni/ae and non-alumni/ae readers. However, magazine advertising is down nationally, and this market phenomenon, naturally, has had an impact on the *Review*'s bottom line. I expect that recommendations based on our analysis will be presented at the June meeting of the Board of Directors.

Also during 1994–95, the Outreach and Bylaws Committee (OBC) of the Board of Directors developed an alumni/ae survey to determine how the Association can engage unconnected graduates. This survey, which will be conducted by members of the Board calling alums in their regions, will supplement the findings of the strategic planning survey carried out in 1994. Under the leadership of Robin Wagner, SM '86, the OBC designed a highly professional questionnaire and provided training to Board members in survey technique. The data from this survey may well provide the background for the next round of Association initiatives.

As I see it, the implementation of the Association's strategic plan is well underway. I think it is particularly noteworthy that much progress has been made during a year in which MIT's reengineering effort demanded a tremendous time commitment from Bill Hecht (and lured one senior administrator entirely out of our shop.)

I'd personally like to thank the volunteers and staff who made this possible, and encourage all alumni/ae (especially the graduate alumni/ae, who are close to my heart) to sign on for the next round of innovation and improvement in our programs. □

R. Gary Schweikhardt

R. GARY SCHWEIKHARDT, SM '73, President of the Association of Alumni and Alumnae of MIT for 1994–95. Alumni/ae may send messages to Gary at (800) MIT-1865 and at <mitalum@mitvmc.mit.edu>.

ClassNotes

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We regret to report the death of classmate **George I. Crowell** on October 6, 1994. He had been suffering from pneumonia, but seemed to be recovering and was looking forward to returning to his residence when he passed away. His son George wrote that his father died at the age of 100 and that he had been active in the family business until the last couple of years of his life. We remember George as a wonderful man who loved our class and attended most of the reunions, including the annual reunions which were started after the 35th Reunion. Many times he would bring one or both of his sons, George and Bruce, and their wives. We were privileged to share many happy moments and delightful conversations with George. May he rest in peace.

By the way, in recent years I have written to the then few remaining classmates, but have not had any responses. Please write so that I can resume correspondence with you and continue our column in the *Review*.—**Bob O'Brien**, acting secretary, 25 Keith Rd., Pocasset, MA 02559

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Please send news for this column to:
Bill Langille, secretary
20 Rogers Rd.
Far Hill, NJ 07931

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Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

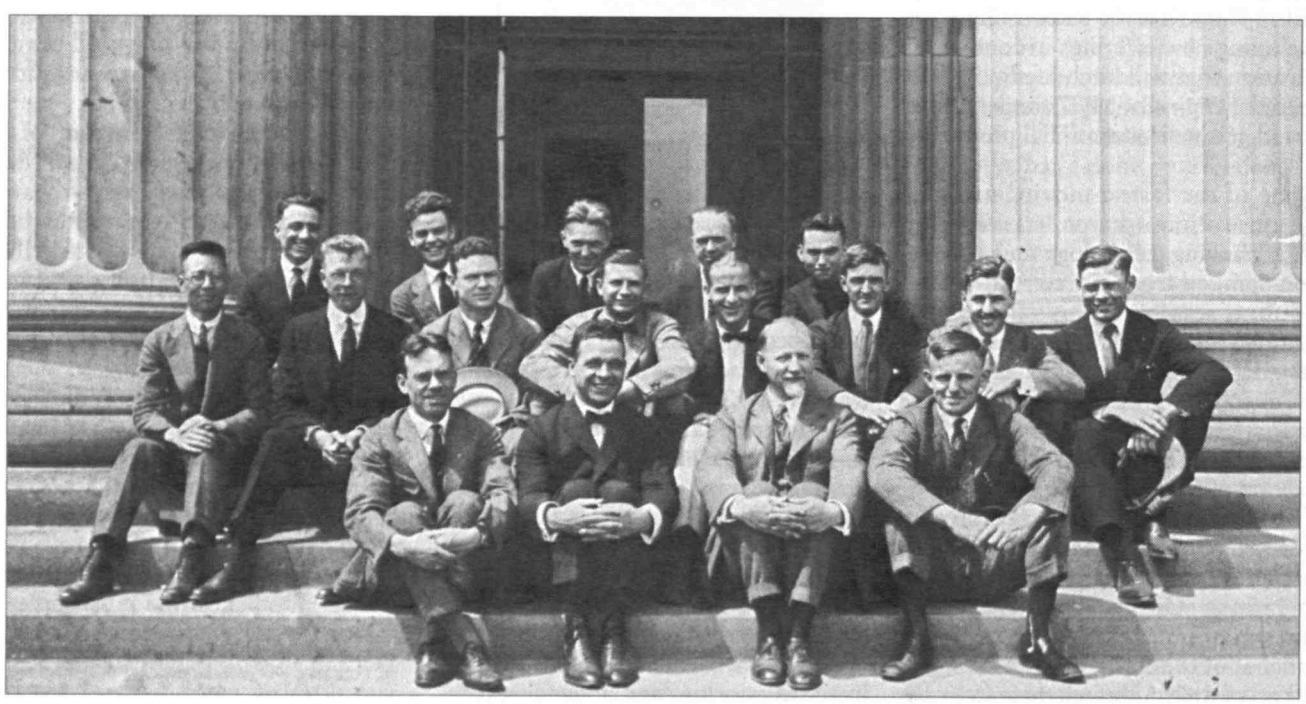
21

Virginia Gimilaro's welcome annual handwritten birthday greetings from the MIT Alumni/ae Association (on a card fashioned by MIT's famous artist and our old friend Samuel V. Chamberlain, '18, reminding us that the Great Court once was a gravel bed with planked walkways and sparse vegetation) again preceded all the happy yearly observances, culminating in last night's gala dinner party by dear neighbors and today's visits of our son and daughter from a distant area of the nation. Thanks!

Also thanks to classmate **Sumner Hayward**, chemical engineering, born exactly six months prior to our arrival—for phoning his good wishes this morning as each of us has done for a large part of the last 78 years!

Edward R. Chilcott was one of 26 undergraduates of our class to make MIT history in electrical engineering more than 75 years ago by becoming a member of the new EE course for five-year study leading to both bachelor's and master's degrees. Proud of his experiences in what is known as "Course VI-A," he has kindly sent us a priceless photograph of 17 of that group together with the professor in administrative charge of the program (see photo to this page).

The informal photo probably was made during 1920 while the entire group had a three-month academic study period at MIT between similar work periods of practical applications at the General Electric Co. plant in Lynn, Mass. Following a long tradition of using the many steep steps of the old Walker Building of Boston Tech on Boylston



Seventeen members of the then newly formed Course VI-A gather on these familiar steps of MIT (circa 1920). They are believed to be (from left): Ralph H. Gilbert, George A. Chutter, Professor William H. Timbie, head of the course, and Edwin L. Rose. Second Row: Chen Chi Wang, Charles F. Longfellow, George F. Owens, Laurence D. Buckner, Paul H. Rutherford, David O. Woodbury, Dugald C. Jackson, Jr., and Edward R. Chilcott. Back row: John A. Scott, Harry M. Witherow, Albion R. Wood, Walter B. Ross, and Clyde L. Chatham. Any suggested changes to the above identities are welcome. See Class of '21 for details.

Street, the group was seated on the steps of the brand new Walker Memorial in Cambridge.

It has taken months of comparing photographs, mainly with those in *Technique*, and applying Ed's and our recollections (we were in the regular Course VI) to determine the identities of all in the picture and we await final comments from **Harold H. Cake** and **Mahlon A. Hartley** on accuracy. Harold tells us that only he, Ed, and Mahlon are survivors of the entire class, which had the distinction of graduating all of its original personnel except one member who was substituted for a dropout in the early days of the course, according to a statement to us by the late **Dugald C. Jackson, Jr.**, member of the class and son of Professor Jackson who headed the EE Department.

Ed Chilcott plans to present this significant piece of MIT memorabilia to the MIT Archives and any proposed changes to the foregoing names list will be passed along with the original picture, if our readers will send them to us.

We thank the Cake-Chilcott-Hartley trio in appreciation of considerable help for these notes. We'll prepare a summary of their personal histories for a later issue.

What MIT photos, stories, or other memorabilia of any degree of general interest can you send us for mention in this column?—**Carole A. (Cac) Clarke**, president and secretary, 608 Union Lane, Brielle, NJ 08730-1423, (908) 528-8881; **Samuel E. Lunden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274; (310) 833-1480

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We have two class deaths to report: **William W. K. Freeman** of Gladwyne, Pa., on January 19, 1995, and **Roger O. Ingalls** of Jamesburg, N.J., on February 12, 1995.

Mr. Freeman worked as a civil engineer with United Gas Improvement of Philadelphia, then New England Electric System in Boston. He joined what is now Arkwright Insurance of Waltham, Mass., in 1937 and retired as chief of the Statistics Division in 1964. After retirement he began teaching Latin and mathematics at the Pike School in Andover, Mass., then at Tower School in Marblehead, Mass., with special emphasis on education in metrics. He served in both world wars, as a cadet in Field Artillery and in the U.S. Navy from 1943 to 1945 on an attack transport in the Pacific. In 1984 he married Charlotte Hume Freeman, his brother's widow, who predeceased him.

Among his many publications were *Training Statisticians in Diplomacy to Maintain Their Integrity*, *THINK METRIC About Weather*, and *Equus Mirus*, a play in Latin for students. For some time he drew star charts for the *Boston Herald* , and he later wrote a weekly column, "Metric News Notes," for the *Salem Gazette*. He was a Fellow of the U.S. Metric Association in recognition of his service.

He was a deacon in the First Church in Salem and organized the square dances there and sang in the choir. His many interests also included mountain climbing and canoeing. He is survived by two daughters: Mary de Forest Jurkiewicz of Atlanta, Ga., and Susannah Freeman Prindle of Chevy Chase, Md., four grandchildren, and one great-grandchild.

Included with the above information was the following note from his daughter, Susannah: "I am writing to thank you for your birthday greeting to my father on behalf of his alma mater, a unique and charming observance. Alas, he didn't quite make it to his 96th but left us peacefully and surrounded by loving friends and family in his final days."

Unfortunately we have little information about Mr. Ingalls. He predeceased his wife, Mildred, and leaves four children: Roger Standish, Patricia Caroline Hope, David Buchanan, and Sandra Amy Hall.—*ed.*

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT/W59-200, 77 Mass. Ave., Cambridge, MA 02139

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Some of you may remember that the Class of '23 has four honorary members with whom I have kept in close touch. Mary and I had a conversation with **Isabel Skinner** and **Phyllis Davenport** before Christmas. They assured us they were holding their own and doing well. **Conchita Pearson**, whose Xmas cards have not reached us in a few years due to mail problems, sent one last year which arrived in mid-January 1995. Her address has changed to J.M. Olloqui 113-101, Mexico 12, D.F. 03100.

In a recent conversation with VP **Harry Kalker**, he told me he is in good shape, has almost given up golf, but does take an occasional dip in the ocean. President Charles Vest and his wife were in Palm Beach for the MIT Club meeting recently and Harry entertained them for lunch.

I tried to reach **Cecil H. Green** to find out what his latest achievements were but he was out of town.

I have one death to report. **William D. Norwood** passed away on January 9, 1994. Bill received an SB in electrical engineering from MIT. He also received an MD from McGill University. He studied nuclear medicine at the University of Chicago and at Oak Ridge. He held a number of important positions and received many awards.—**Royal Sterling**, secretary, 2350 Indian Creek Blvd., Apt. D-201, Vero Beach, FL 32966; (407) 562-3937

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Del Kendall sent me a lovely note in thanks for the pictures of the reunion. He described them as keeping the memory of that "very special day vivid." It was a very special time for me, too. I like his way of putting it.

The Alumni/ae Association sent me a ntofication of the demise of **Frederick H. Reed** in Cornwall, N.Y., October 20, 1994. There was no more information. Anyone knowing of his family or affiliations please write.

We are finally getting *rain* in California. Does anyone know how to turn off the faucet?—Co-secretaries: **Katty Hereford**, 237 Hacienda, Carmel, CA 93923; Col. **I. Henry Stern**, 2840 S. Ocean, #514, Palm Beach, FL 33480

ClassNotes

25 70th Reunion

There is still time to register with the Cardinal and Gray Society and join us for the 70th Reunion. About 30 responded to the reunion letter. However, only the name of **Arthur Sharp** can be added to the four previously mentioned as definitely planning to be at the Reunion. These notes are being prepared in early February and hopefully more will respond positively before May. There were nine maybes in the responses received and that is encouraging.

A Chatham friend recently took a cruise to the Panama Canal and met up with **John Sibert**, who was on the same cruise. John spent many years with the Army Corps of Engineers, and one of his many assignments took him to Panama for several years. Now retired, he resides in Sarasota, Fla.

It is with regret that the passing of four classmates must be reported. **Charles L. Norton, Jr.**, died in Augusta, Ga., on June 3, 1993. Following graduation, he continued on at the Institute working on several research projects. He left in 1936 to join the Babcock and Wilcox Co. When he retired in 1965 he was director of R&D for that company. Charles is survived by his widow, Josephine, and his son, Charles L. III. . . . **Vernon G. Rockwood** passed away in Bradenton, Fla., on September 30, 1994. He was the retired owner of the Gaywood Manufacturing Co. of St. Louis, Mo. He is survived by two daughters and a brother. . . . **G. Winthrop Humphrey** died on November 21, 1994 in Juno Beach, Fla. For many years he was president and treasurer of Old Guilford Forge, Inc., of Guilford, Conn. . . . **Isadore Conrad Berman** died five years ago in May 1989 in Malden, Mass.—**F. Leroy "Doc" Foster**, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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On a positive note, we've heard from **Elton E. Staples** of Winter Park, Fla., who writes, "We continue to enjoy our summers on Cape Cod and for three years have had a home at the Winter Park Towers, a retirement community. Having lost my first wife in 1976, I remarried a Chatham, Mass., friend, Heline, in 1978. We continue to be active in the Camellia Society of Central Florida. We have traveled to Europe many years."

We have a number of deaths to report this issue. . . . **Marian R. Fielding**, MD, of Marblehead, Mass., died at the Carlton Willard Village in Bedford, Mass., on December 24, 1994. She was a specialist in the treatment of arthritis and lupus. Born in Salem, Dr. Fielding graduated from Smith College and earned a master's degree at MIT before graduating from Johns Hopkins Medical School in 1931. She was on the research and teaching staffs at Mass General Hospital and Harvard Medical School. She was author of two books on

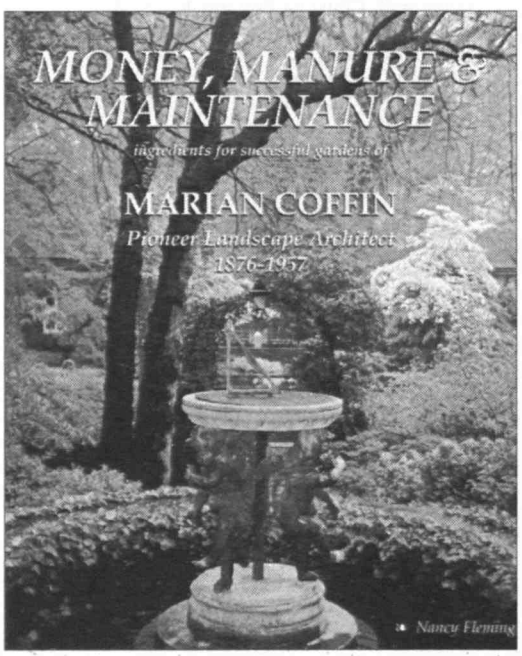
Money, Manure & Maintenance:
Ingredients for the Successful Gardens of Marian Coffin,
Pioneer Landscape Architect 1876–1957
by Nancy Fleming, Country Place Books, $14.95

Beaux Arts Garden Design

By Julie Moir Messervy, MCP & MAR '78

Despite its unromantic title, *Money, Manure, & Maintenance* provides its readers with insight into a bygone world as it explores the life and work of landscape architect Marian Cruger Coffin, MAR '04. Coffin designed the most famous of the gardens at Winterthur, the 1,000-acre Henry du Pont estate in Delaware that is now open to the public, as well as the master plan for what is now the University of Delaware and scores of other superbly crafted gardens up and down the East Coast.

In her book, landscape historian Nancy Fleming offers a thorough and carefully researched addition to the literature on the work of historic figures in American landscape design. If there is a less than passionate quality to the book, perhaps it is because the subject herself was constrained by turn-of-the-century standards of a how a lady should comport herself.



Coffin, a member of a well-established family, had "either relatives or connections in eastern society, no matter the locale." So delicate and frail that she was schooled at home, she nevertheless cherished the idea of being a great artist. "That dream seemed in no way possible of realization," she wrote later in her life, "and though my desire to create beauty was strong, I did not seem to possess talent for music, writing, painting, or sculpture, at that time the only outlets a woman had to express any artistic ability she might have."

When she realized that she would have to earn a living, she was pleased to discover that courses in "landscape gardening" were getting underway in this country. "The most worthwhile course being offered was at the Massachusetts Insitute of Technology, and off I went gaily, expecting to be welcomed with open arms," she wrote.

"You can imagine how terrifying such an institution as 'Tech' appeared to a young woman who had never gone more than a few months to a regular school, and when it was reluctantly dragged from me that I had only a smattering of algebra and hardly knew the meaning of the word 'geometry,' the authorities turned from me in contempt." They nevertheless permitted her to enroll as a special student in landscape architecture, which then included all the requirements for building architecture. With the help of tutoring in mathematics, she completed a degree in only three years.

Coffin had the company of only one other woman in the landscape architecture program. She and her colleague—"thrown in all our work in competition with the men"had their tenuous position compounded by the fact that their discipline was "new and untried." The experience only served to "put us on our mettle to prove that we, too, were serious students and competitors."

MIT's program in landscape architecture was short-lived, and when I enrolled in the School of Architecture in 1974, it was no longer available. Women students, however, still felt that we were interlopers in a male domain. But today, more than 40 percent of the master's candidates in architecture are women.

The world of landscape architecture also has changed considerably from Coffin's time. The bulk of her projects consisted of formal gardens for grand estates where a staff of gardeners took pains to maintain the detailed plans. The Beaux Arts tradition, which consisted of rigidly formal, geometric elements, arranged very symmetrically, was in evidence in Miss Coffin's designs throughout her 57 years of practice.

Unfortunately, what seem to have



Marian Coffin, MAR '04

been the most dynamic and expressive aspects of her work—the plants—largely have died and been replaced by later designers. Trained at Boston's Arnold Arboretum two days a week during her studies at MIT, Marian Coffin was a superb plantswoman with enviable experience. She mastered all aspects of planting design, from plantations of trees down to the placement of plants in perennial borders, and it is a pity that visitors can no longer experience the gardens as she planted them.

In reading this book, I realized how my own philosophy of design is a result of the times I live in, as was Coffin's, and how very different they are. The Beaux Arts tradition taught that architectural order, imposed on every site, would bring beauty in its wake. For me and many of my contemporaries, a design flows from a clear understanding of the constraints of a particular site, coupled with intense collaboration between the designer and client in defining the principles and themes that will govern each project—both post-Beaux Arts ideals that are nurtured in MIT's School of Architecture.□

JULIE MOIR MESSERVY is a Boston-area landscape designer whose first book, Contemplative Gardens, *was chosen by the* New York Times *as one of the best gardening books of 1990. Her second book will be reviewed in the July 1995 Course News.*

lupus, as well as a number of articles in medical journals. She was a member of the board of directors of the New England Home for the Deaf in Danvers and a member of the Appalachian Mountain Club. She leaves a daughter, son, and five grandchildren. . . . **Arthur Howard Lane** of Brewster, N.Y., died July 10, 1994. . . . **William W. Farr** of Southern Pines, N.C., died November 9, 1994. . . . **Gilbert W. Noble** of Winter Park, Fla., died July 10, 1993.

Please send news to: **Donald S. Cunningham**, secretary, c/o Ronald F. Frazier, 132 Middle St., Braintree, MA 02184

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David George C. Luck of Santa Barbara, Calif., died on June 5, 1994. He received a PhD before leaving MIT. Mrs. Leslie Harrington, his daughter, of Chapel Hill, N.C., gave a substantial gift to Capital Gifts at MIT in memory of her father with the words, "I know my father would have wished to support your Scholarship Fund and we both would be delighted." Sorry we have no information about his career.

Milton J. Bearg died on July 16, 1994, in Torrence, Calif. After graduation he went to work for the Cooling and Air Conditioning Corp. and continued in the air conditioning industry for his career. He worked for several companies: Albee Engineering, Air and Refrigeration Co., Ansco Corp., Sanderson and Porter, and Wolff and Munier. In 1950 he joined the Raisler Corp., where he was an HVAC design engineer until retirement in 1974. He and his family then moved to Torrance.

Carl H. Peterson died on October 6, 1994, in East Weymouth, Mass., after a long illness. He was an electrical engineer all his life, working 43 years for Jackson and Moreland Co. This world-renowned firm, started by two MIT engineers, designed power plants and distribution systems that provided electric power throughout the world.

He was a member of the Institute of Electrical and Electronic Engineers, the American Society of Appraisers, and the Orphan's Hope Masonic Lodge in Weymouth. He was a past president of the Brainway Players, a theatrical group, where no doubt he enjoyed the hobby of stage lighting for hundreds of amateur performances. Typical of MIT retirees, he gave back to his community, as he was also an elder deacon of the First Church of Weymouth, and he and his wife volunteered at the South Shore Hospital Gift Shop. His son, Roy, in Hingham wrote that he was devoted to his wife and family. His second wife, Marjorie, is in good health and lives in their home. They enjoyed cruising for vacations and lived for the day they could go on another cruise. Certainly Carl lived a well-balanced, productive life.

Philip N. Rugg died on November 16, 1994, in Portsmouth, N.H., formerly of Wakefield, Mass. Prior to his retirement in 1969, he was employed by Boston Edison as an electrical engineer for 42 years. A longtime member, he was elected president in 1951–52 of the Engineering Society of New England. He was active in the Unitarian Universalist Church of Wakefield. He was a Mason for over 62 years. His wife, Bertha, survives him after 61 years of marriage, and they raised a large family.

We offer the condolence from the class to the wives and families of these four fine classmates.—**Joseph C. Burley**, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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It is a pleasure this issue to take note of movement and activity of classmates rather than loss of members. As a result of damage to his home in the January 1994 earthquake, **Claude Rice** is now at a retirement center at 850 N. El Camino Real, Apt. 246, San Mateo, CA 94401. And though Massachusetts has not suffered an earthquake, **Robert (Earl) Crawford** moved to a retirement home at 355 Blackstone Blvd., Apt. 420, Providence, RI 02906-4936.

Congratulations to **William Hurst** for a Legion of Honor award by the AIME Society of Petroleum Engineers for a 50-year membership and contributions. Bill had previously received the Anthony F. Lucas Gold Medal award for contributions to the scientific community of the petroleum industry and Honorable Membership award by the Society of Petroleum Engineers. Bill also changed his address to 8302 Tessa Ct., Houston, TX 77040.

Unfortunately there is one death to report, that of **George Albert Bernat** on October 15, 1994. Our condolences to his family and friends.—**Ernest H. Knight**, secretary/president, 168 Ai Plummer Rd., Raymond, ME 04071-6349

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Please send news for this column to: **Vincent F. "Jerry" Gardner**, secretary
51 Hill Rd.
Belmont, MA 02178

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65th Reunion

This is the last column before our 65th Reunion in June. The Alumni/ae Office records show that the average attendance at 65th reunions has been 17. As of early February, we had received 13 yeses and 19 maybes. Hence there is a good chance that we will equal or exceed the longtime average by next June. It is contemplated that a further mailing giving program details and costs will go out in late March or early May.

We recently received an information form from **David McIntire** from whom we had not heard in more than 20 years. As of 1973, he retired from U.S. Pipe & Foundry Co. in Burlington, N.J. His latest communication is from Birmingham, Ala., where he and his wife, Bonnie, are now living. His retirement activities include weight training and aerobics. He and Bonnie have a son, David H., three grandchildren, and three "great-grands.". . . We have also received an updat-

ed report from **Morrell "Hijo" Marean**. As previously reported, after Eleanor's death in 1983, he moved to Dallas to be near his daughter, Carol, but soon returned to Florida where he now resides in an "adult congregate living facility" in Delray Beach. For a number of years, he taught math to talented youngsters in Dallas and later in Florida. He has now given up his teaching but is still active as a volunteer counselor on health insurance claims. He says he will probably make it to the reunion in June. . . . **Lester Steffens** had a bypass operation in August 1994 but seems to be en route to complete recovery. He is now living in Norwalk, Conn., with one of his daughters and a young granddaughter who is a "potential Mensa member." He has two other granddaughters who have "SAT scores higher than those of MIT freshmen".

We have at hand notices concerning the deaths of three more of our classmates: **Edward Marnock** on February 9, 1994, **Robert "Jake" Jacobs** on October 20, and **Alfred Waidelich** on November 28. Edward Marnock spent his career in merchandising, first with W.T. Grant and then with Sears. He retired in 1965 as a group merchandise manager and thereafter lived with his wife, Mildred, in Winter Park, Fla. After his retirement, he worked as a financial planner with Variable Associates. He was a member of the Congressional Action Committee of the Winter Park Chamber of Commerce and the University and Racquet Clubs of Winter Park.

Jake Jacobs had a long career with Stone & Webster, starting as a draftsman and ending up as a VP and director at the time of his retirement in 1975. During WWII, he spent several years on the Manhattan Project where his first job was designing the containment vessel for the reactor that Enrico Fermi and his group built at the U/Chicago. Later he was transferred to Oak Ridge where he worked on the electromagnetic separation project. His last job with S&W was to supervise the design and construction of their new office building in Boston and his last official act was to "help cut the ribbon on a building he was proud to say was brought in on time and on budget." After his retirement, he and his wife, Barbara, shuttled between their longtime home in Lexington and a winter home in Ft. Walton, Fla. They were both enthusiastic golfers, and at age 75 he became one of our few classmates to score his age. He is survived by a son, Bradley, who lives in Philadelphia.

Alfred Waidelich received an undergraduate degree in civil engineering from Drexel Institute in 1928 and an SM from MIT in 1930. After spending a year studying in Zurich and Darmstadt, Germany, on an MIT fellowship, he taught at MIT for three years and then spent two years as a professor of civil engineering at Robert College in Istanbul. In 1936, he joined the Austin Co., an engineering and construction company headquartered in Cleveland. While with Austin, he pioneered the development of new designs for welded steel buildings and techniques for the selection of regional and specific sites for industrial facilities. He was a life member of the National Society of Professional Engineers, a member of Tau Beta Pi, and a registered engineer in 47 states and two Canadian provinces. At the time of his retirement from Austin in 1972, he was an S&W director and executive VP for engineering and research. He is survived by his wife, Janet, a son, Michael, of Madison,Wis., a daughter, Janet, of San Francisco, and four grandchildren.—**Gordon K. Lister**, secretary, Apt. 40, 5707 Williamsburg Landing Dr., Williamsburg, VA 23185

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Please send news for this column to:
Wyman P. Boynton, secretary
668 Middle St.
Portsmouth, NH 03801

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Mrs. Louvera Raymond writes me that her husband, **Louis C. Raymond**, died on October 19, 1994, at the age of 88. He had remained active until he was hospitalized in August. Louis had worked for many companies on mining and geological projects in the U.S., Canada, Mexico, South America, the Middle East, Africa, and Australia until he retired in 1973. In retirement he had more time for his amateur painting, especially in oils, and he took a course in archaeology that led to active participation in that field, especially at a local historical "dig," and to the compilation of *Spindle Whorls in Archaeology*.

He had been coleader of his son's Boy Scout Troop, cochairman of the committee that planned and oversaw the building of the present Lutheran Church of the Resurrection in Mt. Kisco, N.Y., and was an active member of the local historical society. He was a member of Lamda Chi Alpha, social fraternity, and of Tau Beta Pi and Sigma Xi, and of SME and AGI, professional societies. He is survived by his wife, three children, and six grandchildren.

Our intrepid travelers Rose and **Tom Weston** are on a tour of the ABC Islands (Aruba, Bonaire, and Curaçao) from January 31 to February 12. Tom says all plans for the Hawaii reunion are practically completed. All those who go are assured of an interesting trip.

We have received information that the following classmates have recently died. **Joseph C. Noyes, Jr.**, on November 16, 1993; **Charles H. Fischer**, on May 4, 1994; and **Philip M. Allen**, on September 25, 1994. When we receive more obituary information we will pass it on to you.

Classmates, to keep these notes interesting, you must write me about anything—your activities, your thoughts on life, health—WRITE! WRITE! Our numbers are dwindling!—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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When I receive correspondence from our very distinguished **Arra Steve Avakian**, it is my number 1 priority to report on some of his activities aside from his MIT educational experiences. When Steve's family first settled in Fresno in 1920, and then on the first Sunday thereafter, his father insisted that Steve attend church. More than attending, Steve became an altar boy lighting candles there for the first time. Now, 75 years later, Dr. Arra Avakian has been chosen a delegate to elect a new Catholicos for the worldwide Armenian Church situated in Etchmiadzin, Armenia. This honor has come to him because of his life-long adherence to and documentation of the historic Armenian Church, particular in its liturgy, its Gregorian music, and its indigenous architecture. This is no small task since Armenia's King Tiridates was converted to Christianity by St. Gregory as early as 301 A.D.—some 20 years before the Roman Empire accepted Christianity as its state religion. During this coming May and October, Professor Avakian will be directing Elderhostel programs at Fresno State College focusing on the Armenian Heritage. It was not surprising to receive a photo from Steve of several models of historic Armenian Churches which he had constructed from paper —his ScD in mathematics served him well in these designs. Steve speaks glowingly of his family activities and of his wife, Georgia. Married in 1939, Steve and Georgia have five children and seven grandchildren.

It is once again my pleasure to report from the once-reticent **Edward R. Atkinson** (PhD, chemistry), who sends an excerpt from the *Boston Globe* by Robert Campbell entitled "Buildings *you* Love" following up on a previous article by Campbell, "10 *Best* Buildings in Boston." Of Boston's *10 Best*, I do agree with a reader who offers the Kresge Auditorium at MIT as "a marvelous little section of a sphere that rested lightly on *four* feet." Even though more remarkably, it actually rests on *three* feet. Ed says that his only contribution to architecture was in the purchase of a glass block for the rehabbing of a ticket window in H.H. Richardson's RR Station in North Easton, Mass.

In a previous issue of *Tech Review*, I noted the receipt of "MIT: Casting a Shadow on the Skyline of Chicago" by Robert Campbell in the *Boston Globe* both from Ed and **Leonard Julian**. Today's mail (January 31, 1995) surprisingly included an invitation to attend an exhibition and lecture sponsored by the MIT Club of Chicago entitled "From Louis Sullivan to Skidmore, Owings and Merrill—Boston Grads Go to Chicago." The lecturer is Kimberly Shilland, curator of architectural collections at the MIT Museum. What a coincidence!

I was knocked out to hear from **Walter S. Galazzi**, Course II. We had an unforgettable experience in the ROTC active duty training at Ft. Banks in Boston Harbor the summer of 1932. Eight MIT recruits were sent into a simulated battle between four observation planes and four attack planes. They were open-cockpit biplanes piloted by some equally raw National Guard pilots training on us. The observers saw no gun emplacements in Boston Harbor and no one was shot down. But those acrobatic maneuvers were something else. I have a few corroborating photos of that flight, obviously before being airborne since we are all smiling, dressed in our hinky-dinky aviator uniforms of the time. Do you remember this, Walter? Walter casually says, "the years have caught up with me....Lucky me, my wife, Ann, has been most caring and competent." Walter and Jo "Ann" de Rego have been married since he received an SM in 1934. Congratulations!

Newland F. Smith, Jr. , Course VI-A, informs that after retiring from his TV broadcasting and computer activities in the New York area, he and wife Caroline retired to their old place in the Berkshires for about 20 years and are now settled in a retirement com-

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munity in Hanover, N.H., with a preponderance of (who else?) Dartmouth constituents upon whom he inflicts his upper-hand knowledge of computers. Our classmate holds several patents on TV circuits and he has published a number of articles on this subject. Yet another brilliant classmate that we should know about!

Richard L. Fossett (president of our graduating class in 1933 and as well president of our class through our 60th Reunion) tries hard to explain his and wife Charalee's absence at our 61st Reunion. Dick writes that he is "having much action" finishing a beautiful retreat home at 5,000 feet in California which will be close to their only daughter. . . . Our present president **Wilber B. Huston** is pushing plans for a greater representation at our coming 62nd Reunion which will be June 15–17. With that in mind, although we are planning an agenda, we invite all you guys and gals out there to offer your suggestions for line item inclusions. We want you to be there!

Looking forward to the 62nd, **Clarence "Clare" Farr** says that he also anticipates a joint musical session with someone professing to be a singer among us. Clare recently purchased a new home in Manchester, N.H., and unluckily, wife Aline suffering from crushed vertebrae has had to resort to a walker and much medicinal care. "*Ratzenfratz!*" that's the way Clare put it. On the brighter side, Clare reports that his Keene High School Class of 1927, boasting 40 strong, held a July luncheon of that class in Keene.

Among the many responses from the 1994 holidays, I very much cherish those from **Edward E. Simpson** (my architectural correspondent) and **John F. Longley**, whose wife, Lillian, sent me a reproduction of a watercolor she entitled "Snowy Stream" and it is wonderfully *cool*!

Forgive me for including a personal note about myself based on two recent letters from **Meyer J. Shnitzler**. He and I lived only blocks away in Roxbury while attending MIT, and before that we lived our boyhoods there without ever knowing one another. I have very happy remembrances of growing up in there. Meyer tells me that Roxbury is now a total disaster and the mayor of Boston is offering financial assistance and *free* real estate to anyone who will rehabilitate the boarded-up properties. Meyer, you've brought me back to Franklin Park playing baseball with the kids of my Samoset Club. I did not know it then but that Club and the counselor assigned to us, put aspirations other than baseball into our hearts and minds. Meyer's late wife who once told him, "You can take the boy out of Roxbury but you can't take the Roxbury out of the boy."

I am saddened to report that two deaths have been confirmed by the MIT Alumni/ae Association. **Adam Joseph Sysko** passed away October 11, 1994, and **William B. Klee** left us on August 12, 1994. Of the two, there is more information on Adam "Ski" Sysko who was part of the 1993 Executive Committee when **Dick Fossett** was our class president. At MIT, Adam Sysko was an enthusiast in baseball, lacrosse, and basketball, of which team he was captain in his 4th year. He also served as Field Day Marshal and on dormitory committees.



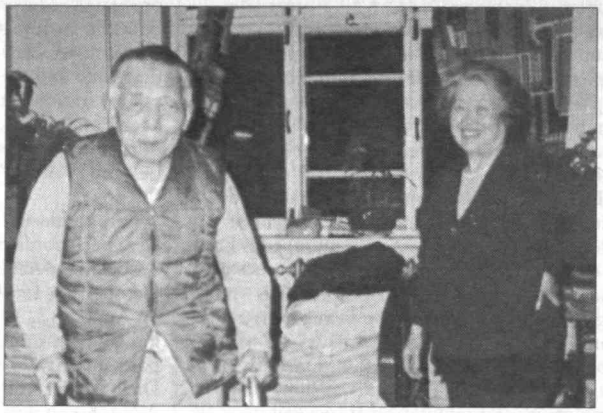
St. Stephen's Episcopal School in Austin, Tex., has named a dormitory, Marshall House, in honor of Courtenay D. Marshall, '33, and his recently late wife, Ima. Above, at the dedication, are (left) Courtenay and Ima with their family.

His daughter, Judith Flannery, said that her father's one great passion, after his family, was golf. He played as frequently as he could and upon retiring he purchased homes adjacent to golf courses in Crossville, Tenn., and Wildwood, Fla. Adam is survived by a son, David; a brother; his second wife, Edith Leach Sysko; and seven grandchildren. Adam and his first wife, Mary Elizabeth Sheehan, were married in 1936. Although Mary Sysko passed on in 1988, a very happy family photo of them can be seen in our 25th Reunion Classbook. Attesting to his career, Adam received an SB and SM from MIT in Course X, chemical engineering. He began work with an affiliate of the DuPont Corp. and continued with them until World War II when he worked on the Manhattan Project. After going back to DuPont, he eventually retired in 1976. All his life, his family interests and boys' clubs activities (including an executive position in the Boy Scouts of America) took precedence over everything else. Adam Sysko will long be remembered by a great array of people, in addition to those who came to know him at MIT. He proved to be one of the best.

I am sure that the passing of **William B. Klee, Jr.**, last August will not be believed by those who observed Bill at the 60th Reunion. Our former secretary was ever the most personable and vibrant being among all of us even down to cajoling my confidence up, very cagily, to take over as class secretary. Bill had written that he took residence in November, 1993, at the Seabrook Retirement Community on Hilton Head. Other than saying "the food frequently is of gourmet quality" that was all that Bill would say. William B. Klee was in Course III (mining engineering and metallurgy) when one summer his employer at MIT, hoping to change the method of wire manufacture, sent the fledgling laboratory assistant to Carnegie Tech night school in Pittsburgh while working for Copperweld Corp. during the day. So Bill up and married Margaret Straus (deceased 1988) with whom he had three lovely daughters who are now scattered far and wide. He spent 10 years at Copperweld still making copper-covered steel wire by the old molten process, never getting the electrochemical process worked out (he said) until Bell Labs did it for themselves. At that time, the year was 1939, Bill was one of three sent to Warren, Ohio, to build and manage a plant of its own to manufacture steel. In his first week there, Hitler invaded Austria and in Bill's words "all hell broke loose." That tiny plant grew to employ 5,000 people producing constructional alloy steels for aircraft, machine tools, and munitions applications. Leaving Copperweld in 1950 because of his health, Bill however

took over as president for an almost bankrupt Damascus Tube Co. and also as chairman of Swan Engineering Co. one year later. These endeavors advanced the quality of welded stainless tubing and pipe to international recognition. Bill's known hobbies obviously lay in creating friendships (he was an Educational Council Member for MIT), antique autos, swimming, and reading. I shall never forget his assuming a Boston accent on his arrival at the 60th Reunion dinner at the Danvers Sheraton Tara saying it was all so "*wonderful to be there on Boston's 'Noath Shoah'..*" He had a mind to enjoy living.

One final word, the 62nd Reunion *is yours* if you will take it in, and, I would welcome any Class of 1933 material particularly on 40th, 50th Reunions. See you in June.—**Berj Tashjian**, secretary, 1245 Briarwood Ln., Northbrook, IL 60062-4556; (708) 272-8683



Wing Lem Wu,'34, with his wife, Yung Sing Lee

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Last issue I mentioned that **Art Miller**'s widow, Rose Schechet, was receiving national attention for her larger-than-life bronze bust of Eleanor Roosevelt. Then late last January the bust was presented to Eleanor Roosevelt College at UC/San Diego. Participating and seated on the stage were about 12 people in front of an enthusiastic audience of 5,000 cheering students, alumni/ae, and guests. Featured speakers were Doris Kearn Goodwin, a Bostonian and author of the recent best-selling biography of Franklin and Eleanor; David B. Roosevelt, a grandson of Eleanor; and Hillary Rodham Clinton. Daniel Shaugnessy, president of the United Nations Association of San Diego County, made the presentation of the bust to the College, and our own Rose stood beside the bust and removed the blue velvet covering at the conclusion of his remarks. All in all, it was a very exciting afternoon. We saw Rose briefly after the ceremony, and she was literally walking on air. She certainly had every right to do so. The bust, completed in 1964, is a magnificent piece of work.



Rose Schechet presents her bronze portrait of Eleanor Roosevelt to Eleanor Roosevelt College at UC/San Diego. See Class of '34 for details.

Walt McKay has forwarded a letter from our classmate **Wing Lem Wu**, whom you know is a retired professor of aero and astro engineering at the University of Beijing, China. Many of our classmates who have been to China visited Wing at the university, where he still lives, although retired. Wing also came to the States a few years ago and attended our 55th Reunion, where he told us of his life in China after returning there upon graduation from MIT. The Society of European and American Returned Students held a reception for a visiting MIT official in August and in September another for a group of MIT alumni/ae who were visiting in Beijing. Wing was disappointed that he could not attend due to his failing health. There is a large contingent of MIT alumni/ae who are members of the society. For any of you planning on visiting Beijing, Wing advises that the society is planning on having open house every Sunday evening and dancing on Saturday evenings. Wing reports that he has not recovered his ability to walk freely since his stroke. He has just received a safe-walker that a cousin brought him from the States. Now that the weather is cooler, he plans on practicing his walking. This past summer has been too murky for any outdoor activity, being the worst in 100 years. With practice, he hopes to regain his ability to walk. He apologized for not sending out Christmas cards to many of us this year, as he was not able to get out to buy them. But he does send greetings through the letter to his many friends in the class.

A letter from **Dick Sanders** tells us that he has moved from Vero Beach to: West Lucerne Circle #1312, Orlando, FL 32801. Two years after Jean's death, Dick has decided that the emotional and practical problems of living alone in his house at Vero Beach was too much, and he has elected to move to a retirement community at the above address. Dick's daughter, Lynn, lives in Orlando. His son, Steve, prodded him into the decision and helped him move. Dick had only been at the new address a week when he wrote, and he is not yet acclimated to the set-up. At lunch, he found that one of his table mates was from the Class of 1928 at MIT. For your information, Dick, **Charlie Finnigan**, one of our classmates, also lives in Orlando. . . . **Frank Moore**, a railroad buff, writes that he is currently engaged in building a little 2-6-2 locomotive model. When he was at Baldwin Locomotive Works, he designed the boiler for this particular locomotive. . . . **William Coleman** writes that he is still going to doctors frequently, and is feeling up and down. He's also being subjected to loads of dental work. The bright part is that his wife, Pat, does a wonderful job of taking care of him. Bill says that they travel very little any more. Thanks for the note, and we hope that most of your days are "up."

Max Winer reports that as CEO of Research Engineers of Newtonville, he is busy as a consultant for the remediation of polluted soils by low temperature incineration, and desalination of drinking water. . . . **Jim Eder** was kind enough to send us a message at Christmas, together with a Christmas card (see photo at right). It includes his deceased wife, Mary, and I am sure it will be meaningful to Mary's many friends in the class. Jim pays tribute to Mary in his Christmas message, and it is a beautiful expression of a husband's love for his wife. Jim reports that last summer granddaughter Clara joined him and some other friends on a most exciting cruise in the eastern Mediterranean. They were on the ill-fated *Achille Lauro* three months before it went up in flames and down to the bottom of the sea. Another highlight of the trip was four days spent with good friends in England. Jim reports that he still tries to play tennis daily, but that on the court, "the only part of me that can run is my nose!" Jim has seen **Jim Sweeney**, in Rancho Bernardo where they are both living, and they hit it off well. Their last meeting was in New York City in 1936 at the MIT-Williams Club. Jim Eder called the other day and invited us to lunch at Rancho Bernardo. Jim Sweeney joined us for a very nice luncheon at the Remington 2, the retirement home where Jim E. is now living. It was the first time your secretary

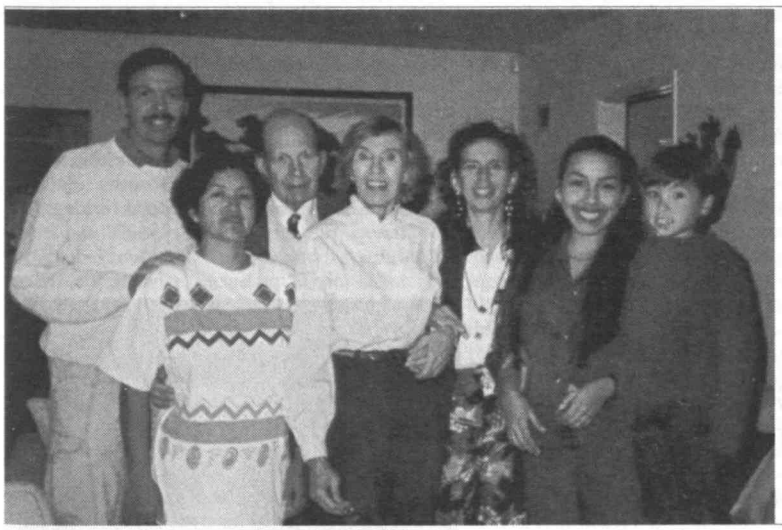
ClassNotes

has seen Jim S. since our 25th. Jim did not recall whether he had been at the 25th or not, but after jogging his memory, he recalled that he had been with Admiral Rickover, the Navy nuclear power specialist, and had come up for the reunion after that. Jim has worked in the ship building industry on both sides of the continent and has been living in the San Diego area for many years. We covered a wide range of topics at lunch. Your secretary told both Jims that most of this material would go into the *Review*. After one rather lengthy discussion by the three of us of our various ailments, Jim E. quipped, "Are you sure this is for the *Technology Review* and not the *New England Journal of Medicine*." When Jim S. heard of the upcoming dedication of the Eleanor Roosevelt bust, he mentioned that he and Arthur Miller had been high school classmates.

Ed Asch sends us Christmas greetings and a report of a marvelous trip that he and Annette took to England and Ireland for a month. Headquartered in a flat near Marble Arch, they spent the month of November (warmest November since 1537) taking in: four plays, six musicals, a Vivaldi concert, organ recitals at Westminster Abbey and St. Paul's Cathedral, a jazz concert at the Royal Academy of Music, visits to fire-damaged Windsor Castle, walking tours in Jack-the-Ripper territory, little known Little Venice, Christopher Wren-designed churches, and countless museums and galleries. They had an opportunity to meet with Ed's British cousins. Annette spent three days in Northern Ireland meeting 28 cousins, five dogs, three horses, and one cat. Quoting: "Like Lake Wobegon, all the men are strong, the women good looking, and the children above average.". . . Mayer Hyman, '31, of Tucson, Ariz., sends an obit: **Bernie Stiller** died December 26, 1994, and is survived by his wife, Thelma; daughter Maria Cohen of St. Louis; son Charles of Miami, Fla., and son William of Morristown, N.J.; seven grandchildren; and a sister, Rose Medoff of Brookline, Mass. Bernie spent his entire working career with the U.S. Corps of Engineers, and the U.S. Atomic Energy Commission as manager of the Paducah, Ky., area. He and Thelma retired to Tucson, Ariz. He was an active member of the Tucson MIT Club. Condolences from the class have been sent to his family. . . . A letter from class president **John Hrones** brings the sad news that **Bissell Alderman** has lost his wife, Mary Compton Alderman, daughter of Karl Taylor Compton, who told us at Freshman Camp that he considered himself a member of our class, as he was starting at MIT that year as well. As might be expected from a daughter of Karl Taylor Compton, Mary was very active in many community affairs. Besides Bissell, she leaves three daughters: Jean Hazen of South Hadley, Mass.; Mary Lord of Weston, Mass.; and Holly Alderman of Belmont, Mass.; a brother, Arthur Compton of Sebastian, Fla.; nine grandchildren; and two great-grandchildren.

On a happier note, treasurer **Larry Stein** and his bride, Jeri, of 50 years, celebrated their golden wedding anniversary on December 27, "right here at home by ourselves. It was very cozy. The real celebration of our family of 16 (four children, four spouses, six grandchildren, and ourselves) was dinner January 7, at a local Chart House, followed by breakfast next day at our house. It was wonderful to have had the whole gang with us and to reflect upon some of the highlights of the past 50 years. Where did the time go? A grand time was had by all."

We have a prominent article from the *Boston Globe* of December 3, 1994, reporting the death of **George Cunha**. George was a leading authority on the preservation of books. He joined the Navy after graduating from Tech, and did a brief stint as a chemist in Cambridge. He graduated from the Naval College, became a combat pilot, and participated in some of the first carrier-based attacks on Japan. He was awarded the Distinguished Flying Cross for his efforts. He stayed in the service and his last assignment was on the Joint Chiefs of Staff in Washington, D.C., where he haunted the Library of Congress and its supporting libraries to learn everything he could about the restoration of books. After retiring as a captain, he became chief conservator of the Boston Athenaeum, where he did some marvelous restoration work. Perhaps his outstanding accomplishment was the restoration of a whaling journal which had been blown up because it was suspected that the package contained a bomb. It arrived as a collection of paper bits in a plastic bag. George restored it except for a star-shaped hole in the center. He retired to Kentucky in 1980. He leaves two sons, James and George, Jr., a brother Robert, a sister Constance, 14 grandchildren, and two great-grandchildren. The class has sent its condolences.—**Carl H. Wilson**, secretary, 48 Druid Hill Rd., Newton, MA 02161-2033; (617) 527-7088





A Christmas card from Jim Eder, '34, includes (from left) Jim's son, Martin; granddaughter Clara; Jim and his late wife, Mary; Martin's wife, Nancy Maria; granddaughter Ana, a freshman at UC/Santa Cruz; and grandson Daniel, a second grader at a magnet school in San Diego.

35 60th Reunion

Wesley H. (Wes) Loomis III writes from his life-care retirement residence in Plymouth Harbor, Fla., into which he and Polly recently moved. They have a superb dining room and other amenities, have instant access to medical facilities, and are among a host of friends. Wes also states, "We enjoy a spectacular view of the southern end of Sarasota Bay, the channel into Big Pass, and the Gulf of Mexico." Ellen and **Lester (Les) Brooks** got off to a rocky start missing a connecting flight in Miami but finally reached a gorgeous sandy beach in Holetown, St. James on Barbados. Warm water and a nice hotel cleared the air for them. They were to take a 6-hour bus ride around the island to learn some of its history. Les planned to play a round of golf, but the tab was only $125.

A note from **Walter (Stocky) Stockmayer** arrived with an interesting question and possible solution: "Will we have an VIII next June at MIT or only a IV? With help of a derrick, we can get in and out of the boat." **Hal Everett** reports he and Florence enjoyed nine weeks on Cape Cod last summer. They visited with their daughter who is director of communications for Tilton School in Laconia, N.H., and two sons, one in Northampton, Mass. who is a schoolteacher in South Hadley and the other, an attorney in Fairfax, Va. Hal is still serving on the Board of Adjustment for the City of Flagler Beach, Fla. They are currently investigating retirement communities from Boca Raton, Fla., to Brunswick, Maine, but are not ready yet to make a commitment. They are looking forward to our 60th. A

report arrived from **Stanley M. Lane** in Helena, Mont.: "Pretty much just hanging on. Playing golf and bowling in season. Scores are about the same."

Arthur L. Haskins writes from Bath, Maine, that not much changes there, that he is still involved in "pleasant yard-work, joyous church work, minimal boat work, exciting sailboat racing, as little cooking and housework as possible, and a lot of desk work." For the first time in 37 years he missed the Casco Bay Regatta. But he managed to get his *Surefire* ready in time to take second place in both the Tanzer 22 State of Maine Championship and the Merriconeag Yachting Association August Series. Daughter Carolyn retired from teaching last spring so she and her husband, Wayne, are able to spend more time together at their Colorado mountain home. Son Dan is busy as ever at the local yacht club but still finds time to help his Dad around the house.

David J. Buckwalter writes with very interesting news from Tucson: "Since Jean and I met Maxine and **Bud Fetters** in Salt Lake City in 1942, we have remained good friends and taken many vacation trips together. This friendship continued when Maxine lost Bud six years ago and I lost Jean two years ago this March." The result: Maxine and David were married August 11, 1994, followed by a honeymoon cruise of the Mexican Riviera aboard the *Nordic Prince* which was most enjoyable. **Arthur H. Cohen** writes from Boca Raton, Fla. He and his wife, Joyce, celebrated their 55th wedding anniversary on February 6th and plan to stay there until they move back to Belmont, Mass., in April. They spent last Thanksgiving with their younger daughter and her family in Portland, Ore. Their older daughter and family live in Short Hills, N.J.; their son and daughter-in-law live in Montclair, N.J. where he is in advertising and she is in costume design. They are looking forward to our 60th.

We celebrate the lives of three more of our former classmates: **John E. Kiker, Jr.**, died on June 28, 1994, **William Gregg Fry** died October 10, 1994, and **John C. Alden** died October 17, 1994. **John Kiker** was in Course IX-B and his son reports he died at his home in Americus, Ga. **Gregg Fry** was in Course XV and died after a long illness in the Park Health Center, Fairfield, Conn. He was the retired owner of the W.G. Fry Co. of Holyoke, Mass. He was an active supporter of the Bridgeport Symphony and the University of Bridgeport. He served in the Navy during World War II. He is survived by his wife, Frances Richards Fry. **John Alden** was in Course I and died in his Concord, Mass., home. He was an employee of the Boston & Maine Railroad from 1935 to 1975 starting out in the Passenger Traffic-Law Department and in 1953 as claim agent-Fitchburg Division. He was a Life Member of the Appalachian Mountain Club and made many trips by rail worldwide. As a mountain climber he spent three weeks in Nepal trekking from Kathmandu to Thangboche at an elevation over 12,715 feet with "good views of Mt. Everest." He is survived by his wife, Anna Cole, five sons, and three grandchildren.

I hope all of you will be in Cambridge on June 14 to 18 for our ONE-TIME 60th REUNION. See you there!—**Allan Q. Mowatt**, secretary (my 30th year), 715 N. Broadway #257, Escondido, CA 92025; (619) 432-6446

36

When natural disasters occur, our classmates in the area seem blessed with good fortune. In the 1991 New England storm, **Bill Hastings** suffered wet floor boards in his car and **Lou Stahl** lost 150 feet of seawall but their homes and others we know of were spared. Then last October at Lake Conroe (17 miles long and up to 6 miles wide) above Houston, Tex., Lucy and **Charlie Holman**'s waterfront home was threatened by water rising within a few inches of the slab foundation. Their dock and lawn were submerged but the level peaked when outflow was increased to 15 million gallons per minute to save the earthen dam. . . . Now, in mid-January at Napa Valley in California, Gabriele and **Al Horton** saw a small stream rise to within two inches of a foot bridge built by Al to a helper's cottage, but no damage. They had 10 children and grandchildren for the Christmas long weekend, with some young ones using a studio also built by Al. His stroke disability is about the same with much use of the wheelchair.

Bernie Gordon's career has focused on dams and reservoirs, and I called for expert first-hand information on the deluge. But I learned that he has been in a convalescent home since a bad fall in October. Wife Dorothy told of his ongoing osteoporosis, a weekend furlough for

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KATHARINE DEXTER MCCORMICK '04 SOCIETY

The McCormick Society was established to honor one of MIT's greatest benefactors and to recognize and thank donors who give to MIT through life income fund gifts, outright bequests and other deferred gifts.

Katharine McCormick gave to MIT in gratitude for her scientific education, which, she stated, was of inestimable value to her throughout her life. Like this generous alumna, the members of the McCormick Society enable MIT to plan for the future with confidence and strength.

If you are interested in supporting MIT in this vital way or if you have already done so, please let us know. Write or call:

Mr. Jack Dresser
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their wedding anniversary, and his expected homecoming about March 1. . . . The aftershocks of the Japanese earthquake at Kobe continue as I write, but the homes of our classmates, **Tom Kato** (XV) and **Taichiro Hori** (VI) are in Tokyo 250 miles away. News reports say there is little or no vibration felt.

A card from **E.R. "Mike" Pettebone** tells of their move from Albuquerque to Chandler, Ariz., near Phoenix on January 6. Too bad—Mike's wife, Peggy, and my wife, Phoebe, have yet to meet. For about two years, there were four '36ers in New Mexico but **Carl Hedberg** (VI) has disappeared from Rio Rancho and may be dead. Only **Phil Hart** and I remain. . . . Last June, Helene and **Ollie Angevine** found a note in their mailbox: "If you ever decide to sell your home please let us know." They had only thought of the possibility but with help from son Peter and daughter Anne in Charlotte, N.C., they found a house and moved in September. The new ambience is fine—family nearby, easy shopping, church, social life—and the climate is a pleasant change from East Aurora, N.Y. A paper by Ollie for the *International Journal of Active Noise Control* will appear in its first issue. . . . **Roman Ortynsky**'s research in his file of *Techniques* prompted "memories of the 5.01-5.02 recitation class of Professor 'Smokey Joe' Phelan, with **Alice Hunter (Kimball)** sitting in front of **Bill Mullen, George Parkhurst, Ken Arnold** and me, Alice shielding us from his questions."

If you were perplexed by the discontinuity in January Notes' first paragraph, you have company. Between the first and second sentences, two others fell through the printer's safety net. These referred to the dormitories, Graduate House, apartments, and fraternities on Memorial Drive, including "Theta Delta Chi at #314, which could sleep only 14. Other members —". However, considering the tremendous volume of words in Class Notes, sometimes more than the rest of *TR*, and the large amount of uncheckable material, the editors do a highly commendable job.

Cheers for the lives of **Harold Brown** (Course XIV), **Douglass Hawks** (XVIII), and **Stanley Levitt** (I)! Harold died on November 2, 1994, after 13 years on dialysis, which failed to dampen his active consulting work on lasers and fiber optics. After World War II service in metallurgy at the Naval Gun Factory (Cmdr, USNR), he moved freely from Raytheon to Sylvania, to Electronic Metals and Alloys, Inc., to Avco Research, to U.S. Steel Labs (where he was co-inventor of austempering)—"wherever there were interesting challenges and/or increased rewards." His wife, Muriel, died in 1993. His cousin **Ken Swain** (II) sent the obituary and told of the spirit of the man and his remarkable career. . . . Ken lost his wife in 1990 and is using a cane since last summer when his arthritis reared up, but is in good spirits. . . . **Doug Hawks** was hospitalized a few days with heart trouble and died on December 25 of that "angel of mercy"—pneumonia, as he wished. His career in quality control moved from one aerospace company to another, as the vagaries of civil and military contracts created need for his services. Doug's ex-wife, Eda, wrote an obituary to the Alumni/ae Office telling of a son, William, who earned the Bronze Star in Vietnam, and a daughter, Ann Henderson, whose two sons won appointments last year to West Point and Annapolis. On the telephone Ann recalled being 10 years old when **Tom Kato**'s two daughters came from Japan to live with the Hawks for high school senior year before entering the University of California.

A note from Carol Levitt Schwartz tells of the death of her father, **Stan Levitt,** on March 12, 1994: "A fascinating man—we were always proud of his MIT connection." He entered our junior year from University of North Carolina and played varsity tennis. Then he took graduate courses at LSU and did engineering for the Louisiana Highway Department. During World War II he was on the Manhattan Project for Eastman-Tennessee at Oak Ridge. After 1952 he owned and managed a men's clothing store in Midland, Tex. His 50th biography highlight was "my marriage to Hilda and our two fine children." When Hilda died in 1986, Stan established a school poetry contest in her memory. He would have been especially proud of Carol last November election day. With the political party affiliations 10-to-1 against her, she won 42 percent of the vote for mayor of Washington, D.C.!—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501; (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570; (914) 769-4171

37

Our first note this month is from **Charles Antoni,** former professor of chemical engineering at Syracuse University who reports one of those surreal incidents: "Surprised last month in the Los Angeles Hilton to see the name *Dreissigacker* on a name tag. I commented that I had gone to college with someone with that rare name." "My dad, no doubt" replied the tag-wearer. . . . Next, our reliable roving reporter **Hobby Hobson** summarizes his doings: "See **Joe Keithley** often for lunch in Cleveland. I have seen **Art Zimmerman**, who is moving to Port Washington, Mich. Hope to see **Al Busch** and **Roger Wingate** soon." Hobby keeps busier than any of us, I'll bet. His large family is quite spread out, so that he is frequently seen in St. Lucia, the West Coast, London, Cleveland, and Rye, N.Y. His Abanaki Corp., (previously reported in these notes) continues to grow and prosper. Adding to this family travel last year, he was in Miami and Naples, Fla.; Londonderry, Vt.; Alexandria and Charlottesville, Va.; Nashville, Tenn.; Cooperstown, N.Dak., Seattle, Wash.; Vancouver, B.C.; Tryon, N.C.; and Sturbridge, Mass. There's more but we are running out of space. He is certainly one man who gets full value from his airline passes. Keep it up, Hobby. You're a wonder.

Tom O'Brien briefly reports that he decided to retire last year—"one month before my 80th birthday, while I could still remember how to retire. Am enjoying it immensely."

Joe Smedile writes a very newsy letter from Delray Beach, Fla., where he lives right on the Intercoastal Waterway: "We were spared by tropical storm Gordon, although we lost some roof tiles and a few tree limbs. Our flowering plants were stripped of leaves and flowers. I had trouble keeping our small pool from overflowing because of a damaged seal, which I finally fixed in the pouring rain." The health of Joe and his wife, Martha, had them concerned, but after a full battery of medical tests,

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they both passed with the doctors' welcome "come back in a year." Nevertheless, Martha has had steady physical therapy both from a "snowbird" in the south and a clinic "up nawth," (quoting Joe). He has been active in the Homeowners' Association, where he is on a legal committee reviewing and revising the by-laws. Summarizing, Joe says, "All in all, it was not the best of years, but to quote a New Englander, 'it wasn't half bad either.'"

Norm Birch and his wife, Elvie, have been traveling and had a good time participating and enjoying a number of activities inside and outside the country. Included were: an Elderhostel at Gulf Coast Community College at Panama City Beach, Fla.; a visit to California to attend a wedding and a visit to the magnificent redwoods at Muir Woods; a visit to South Carver, Mass. "to prepare for the sale of our property there, after 27 years of pleasant memories"; a cruise to Cozumel, Mexico, from Tampa, Fla.; to Nashville to visit grandson Jordan, a freshman at Belmont University, then to son in Louisville, Ky.; attended Fine Arts Program at Florida Southern College; took the "Fifty-Alive" driving course and earned a CPR certificate; a week's cruise from Jamaica to Costa Rica, Panama Canal, Cartagena, and Aruba. . . . From his sister Mary, we learn that **John Nugent** gave her a lovely party on her 90th birthday with some 60 dear friends in attendance. John was ever *the man.*

If you enjoyed reading about the doings of your classmates, get busy on the typewriter and tell us about yours.—**Leonard A. Seder,** assistant secretary, 1010 Waltham St., B342, Lexington, MA 02173; **Robert H. Thorson,** secretary, 66 Swan Rd., Winchester, MA 01880

38

Under the heading of "A Lifetime Passion" the Appalachian Mountain Club publication *AMC Outdoors* in January-February 1995 pictures **Mead Bradner** and honors him for more than 40 years of stewardship on the Warner Trail in Massachusetts and Rhode Island. Mead is quoted as saying that on the 30-mile trail he can walk all day and not see one sign of the civilization that bustles just a few miles away. Since his friend Ron Gower passed away, Mead has been the primary caretaker of the trail, and his perseverance earned him a Greenways and Trails Award for exemplary stewardship from the Massachusetts Greenways and Trails Council.

"Protecting and managing a long distance trail in this particular area, especially with the rapid development of open spaces in these past two decades, has required unrelenting perseverance, dedication, vision, labor, and energy," says Kevin Knobloch, AMC Trail Director, who presented Bradner with the award at a Greenways gala. "Mead Bradner has successfully brought all these resources to bear, and we, the future generations, are the beneficiaries."

Don Severance sends us excerpts from a letter he received from **Clark Robinson** and his wife, Rachel. "We have a 20-acre tract in Bozeman, Mont., with some bottom land meadow, mostly sage brush, rocky ridges about 200 feet high, and around 10,000 mature Douglas Fir trees. We acquired this in 1983 with a seasonal house on it. Over the years we have rebuilt and added to the house, and moved here full time about two years ago. It serves our needs very well. We are 14 miles from the nearest town of Clyde Park with a population of 282. I have a full-sized plow which I put on a Dodge pickup in the winter to clean our 300-foot gravel driveway. I gave up the Russian translation activity in 1991 at the same time that I finished a four-year stint as 911 coordinator for Gallatin County and the city of Bozeman. In addition to necessary maintenance and household chores, Rachel paints and I work on radio communication. It is interesting to observe the reflection of 2-meter waves from the nearby mountains. I am a sort of antenna specialist. We are both in good shape so far and expect to stay here as long as we can, but we are trying to find out what we can about retirement communities. We are not committed to remain in the west, nice as it is."

Bernard S. Lement of Lement and Associates of Waltham, Mass., writes, "I am still self-employed as a materials engineering consultant and mainly do accident investigations for attorneys and insurance companies who require me to give testimony as an expert witness on occasion. I just underwent a second hip replacement and am now a symmetrical multi-component person. I expect to recover by April and resume my tennis playing which is my major hobby and where I was ranked in senior tennis NELTA before my first hip replacement in 1988. My other hobbies are chess, English country dancing, and cosmology. I recently submitted a paper on the rates of recession velocities of the galaxies due to the Big Bang to the *Journal of Astrophysics.*"

From Hampstead, N.C., **Robert D. Solomon** writes that although he is semi-retired he is still active as adjunct professor of biology at the University of North Carolina-Wilmington. He has completed his 57th year as a member of the American Chemical Society, and is listed in both *Who's Who in America* and *Who's Who in Science and Engineering.*

Fred Kolb reports on the Harold Edgerton "Strobe Alley" exhibition that opened at the George Eastman House Museum in Rochester, N.Y. "In addition to the examples we saw while we were at Tech, there are pictures taken in wartime Italy with Doc's airborne flash in a B-17, and pictures of nuclear explosions taken with an extremely fast camera shutter." The MIT Museum loaned some of its equipment to Eastman House permitting some hands-on displays. Fred encourages you to look for this exhibit, which will leave Rochester in the fall of 1995 and travel to science museums in North Carolina, Seattle, and Boston.

Sol Kaufman advises that both he and Sylvia are well and keeping busy. He is still working but on a slightly abbreviated schedule. Sol is still involved with Hebrew College as chairman of the board of managers of the endowment funds and as a board member of the MIT Hillel Foundation.

Sol sent us a clipping from the *Boston Globe* announcing the death of **John F. Glacken** on January 13, 1995. John, who was a civil engineer, served in World War II and was engineer of the City of Cambridge before his retirement and move to East Falmouth, Mass. He was a regular attendee at our mini-reunions at Endicott House.

This is the last notice for our June 17–18

mini-reunion at Longfellow's Wayside Inn on the Boston Post Road in Sudbury including dinner at 7 p.m. Saturday the seventeenth.—**Paul R. Des Jardins**, secretary, 6251 Old Dominion Dr., Apt. 310, McLean, VA 22101-4807; (703) 534-4813; **Gretchen Birge**, assistant secretary, 233 Carroll St., Apt. 202, Sunnyvale, CA 94086-6264; (408) 736-5011

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Both the times and MIT's admission process have changed. In September 1935, 600-plus applicants became freshman members of our MIT class of 1939. But, to enter MIT 57 years later—in 1994—thousands applied. At MIT their applications were independently read anywhere from two to four times by admissions officers, with assistance of faculty members and senior administrators. Then, in a grand decision-making round, over 6,700 applicants were reviewed, not just for suitability in the abstract sense, but in relation to the entire pool of applicants, to determine those most likely to thrive at MIT. In September 1994, only 1,107 applicants became freshman members of MIT's class of 1999. Forty percent of them were women and 15 percent were under-represented minorities.

Don Donatello, Course X, was honored to be elected to the Alaska Business Hall of Fame. The confirmation ceremony was reported in a four-column article with Don's picture in the magazine *1995 Alaska Business Hall of Fame* established to honor champions of free enterprise and to present role models in business for young people. Former Governor Walter Hickel said "...There is something about Don Donatello that makes him stand out from other business owners. 'That something' might be Don's attitude. His diversified company grosses more than $10 million annually because he never says 'cannot.'" In 1965, President Lyndon Johnson presented Donatello with the U.S. Small Business Administrator's Small Business Business Person of the Year Award. Don and Jean have five children, four of whom are active in the business.

Bob Withington and Betsy welcomed **Hewitt Phillips** and Viola to their Mercer Island home for what turned out to be a seven-hour '39er mini-reunion for nine-plus-one. The Withingtons are hosting two students from Europe for three months. Before the gourmet dinner prepared by Betsy, host Bob led a viewing of the two-seater monoplane he has been assembling in his shop and shed. After 2,500 hours of his tender loving care, the plane is 95 percent ready to fly. The motor is in place, after having received significant Withington-modification, and ready to receive the three-bladed propeller. The instrument panel is ready for instruments. The under-carriage (two wheels plus tail skid) which now supports the plane will be replaced by pontoons with retractable wheels. When finished, the plane will weigh about 700 pounds and cruise at 100 miles per hour. Altogether a most impressive sight to view! Classmates having use for a virtually-new under-carriage assembly with two wheels and a tail skid might negotiate a deal with Bob.

During a previous mini-reunion in Seattle, Hewitt Phillips gave a fascinating review of an airplane designed about 1900. (In England, the Maxims, father and son, built a biplane driven by two eleven-foot-diameter propellers powered by two on-board two-stage steam engines!) On this second visit to Seattle, Hewitt entertained listeners with stories including one about the hand-held, hand-launched glider he and three NASA colleagues designed. In 1994, that glider established and still holds the world record for longest flight in zero-velocity air. Viola Phillips mentioned a Phillips grandchild won a spelling championship in Virginia last year.

Hal Seykota told how luck enabled him to overcome the Portuguese-English language barrier in 1947 and thus expedite construction in Rio de Janeiro of Brazil's first commercial plant to make 99.7 percent pure CO_2 liquid and dry ice. Hilda recounted experiences with rats and mice who were uninvited intruders to the house the Seykota family leased on the Caribbean at Cartagena, Colombia, during a 1962 assignment.

John Alexander was stimulated by a challenge to optimize propellers used for small and medium-size boats. Nancy continues significant giving to charity and is donating hundreds of hours again to others who need help preparing personal income tax declarations.

Since **James Barton**'s passing, Mary has been surrounded by the love and goodwill of family, friends, and many '39-ers and Sloan graduate alumni.

After the mini-reunion dinner, reminiscing continued around the fireplace. We recommend with enthusiasm that mini-reunions be held by the 275 surviving '39ers.

Bill Wingard and Anita are comfortable in retirement quarters in Catonsville, Md. Bill calls now and then on his sons who operate the machine shop business. On the day I phoned, Bill had prepared a breakfast for two of buckwheat hotcakes and then worked off some calories by shoveling new-fallen snow from the sidewalk.

Seymour Sheinkopf and Sylvia report that **Art Zeldin** and Helen plan for a cruise in the Caribbean. . . . **Mel Falkof** and Lucille toured Vietnam and Cambodia for three weeks, then Moscow and St. Petersburg before attending our 55th Reunion. After a four-day family reunion they celebrated their 50th wedding anniversary, and left immediately, on behalf of the Executive Service Corps, to start a two-month assignment in Costa Rica for a supermarket chain. They made no mention whether they visited classmate **Chris Rosas** in San Jose. For years after graduating in chemical engineering, Chris owned and operated two large whaling enterprises in Peru.

Tony Arias will come from Madrid to attend celebration, stateside, of his 80th birthday. . . . Mrs. **Irving Peskoe** is about to sell the house in which she and Irv raised their family in Homestead, Fla. Classmates who know others who seek property tested to survive weather extremes may create a win-win happening by referring the seekers to Bea.

Barry Graham and Wendy made a three-week tour of China before the 55th class reunion. They made five flights in Chinese commercial aircraft and Barry was favorably impressed. . . . **Dick Christie** and Barbara enjoyed October at their place in Boulder, Ariz.

We are saddened by news of deaths of two classmates: **William Egler Haible,** partner in the Boston architectural firm of Anderson,

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Beckwith, and Haible, died on December 3, 1994. He graduated from Colorado University at Boulder in 1936 and completed architectural studies at MIT in 1939. He served during World War II on US Navy destroyers in both Pacific and Atlantic theatres. He received prestigious awards for his designs of Lincoln Elementary School, and buildings of Raytheon Co., Kennecott Copper, and Ginn Publishing. He was a fellow of the American Institute of Architects, a member of the St. Botolph Club of Boston, and he supported the Boston Symphony Orchestra and the Museum of Fine Arts. He had a life-long interest in sailing and participated in several transatlantic crossings and a Bermuda Race.

John Albert West, Jr., died September 4, 1974. He resided in W. Southport, Maine. There were no details.—**Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407

40 55th Reunion

Class Treasurer **Richard Babish** provides much of the news for this column from responses to his invoices for class dues.

Robert Gould described his visit last winter on a bitter cold day to check out his summer camp. Shortness of breath then was followed a week later by a difficult ski trip. An examination showed that he had suffered a heart attack requiring a quadruple bypass. This was unfortunately followed by a stroke resulting in partial paralysis. He is recovering now, and, with the help of therapy and exercises, he is driving once more. If he makes sufficient progress, he will come to the reunion.

A note from **Herbert Arnold**'s wife, Rose, states that he is not in good health, will be unable to go to the reunion, but is always very happy about his year at MIT. . . . **Tom Perkins**' daughter, Nancy, writes that Tom is in a nursing home, and she asks to have his name removed from the mailing list. . . . **David Fleming, Jr.**, missed the 50th Reunion due to illness in the family, but hopes to make the 55th. . . . **Tom Ferrill** expects to make the reunion, and is looking forward to seeing friends at Woodstock and Cambridge.

Wesley Pendleton, who received an SM with our class, wants his name added to the list. He attended the mini-reunion in Florida. Other additions to the potential attendee list are **Ralph Millet** and **John McEvoy**. . . . **Alvin Guttag** writes that recently he had visited his grandchildren in Sugar Land, Tex. His son is graduating from Harvard Divinity School in June, but the date does not conflict with the reunion. . . . **Abraham Rockwood** sent a note that a former classmate at Hebron Academy mentioned that **Richard Wheeler** had passed away. Dick was one of the people on our list of missing class members. At present there is no further information.

Charles Edwards sent a summary of activities in which he and D.J. participated during 1994. They rode the Napa Valley Wine Train, hiked along the Silver Fork of the American River, visited a camp in Big Basin Redwoods State Park and rode the Santa Cruz Big Trees and Pacific R.R., rode the steam powered Skunk Railroad near Fort Bragg, revisited Glacier National Park after 31 years; and took a trip to Sweden, Germany, and Switzerland.

Charles DeMailly writes that he has three children, eight grandchildren, and one great-grandson. He still plays squash and tennis, and boating is a major hobby. He has finally retired after 50 years at "exciting fun and struggle as a leader in listed corporations, a couple of personally owned enterprises that were successful, and a fling at real estate development that was more exciting than profitable." He only regrets retiring too young, at 72.

From **Clement Burnap**: "Joined Intercity Testing and Consulting on November 14, 1994, as director of business development in the California Office. This is my third forensic engineering company, and I bring some 4,500 claims people and attorneys to them. Finished my assignment as Democratic Party precinct captain. Very interesting; but that's the last time." . . . A note from **Robert Hess** states that he has a new knee, but expects to resume travelling as soon as he regains his mobility. He is revelling in his grandchildren, ages two and six months. He says, "What fun grandparenting is!"

On October 11, 1994, **Joseph Havens** passed away. There is no further information.

When you receive this issue of the *Review*, it will be close to the time of our 55th Reunion. There have been a number of letters from Class President **Norman Klivans** dealing with various aspects of the festivities and events. Co-chairs Sally (Mrs.) **Bob Bittenbender** and **Bill Stern**, with a strong assist from **Phil Stoddard** have the entire program well under control. At the class meeting, a new set of officers must be elected. If you have any thoughts of who might fill some of the slots, be ready to make the nominations. It will be a great time and a fine opportunity for renewing old friendships!

In the meantime, and especially those of you who will be unable to be present at the reunion, keep those letters and telephone calls coming.—**Richard E. Gladstone**, secretary, 250 Hammond Pond Parkway 1205 S., Chestnut Hill, MA 02167; (617) 969-5161

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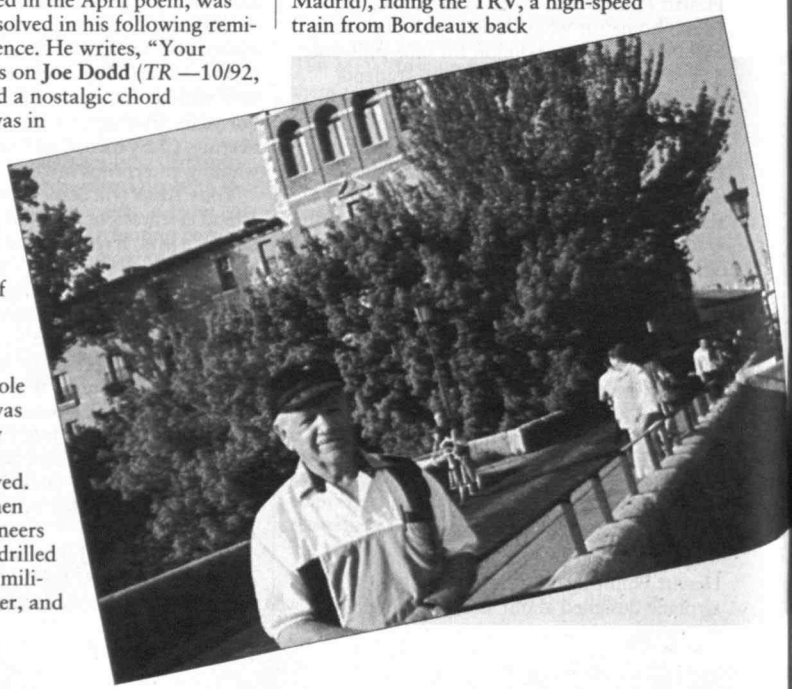
The mystery of **Bob (Wallace) Blake's** summer pilgrimage mentioned in the April poem, was not solved in his following reminiscence. He writes, "Your notes on **Joe Dodd** (*TR* —10/92, 4/93, 1/95) plucked a nostalgic chord in my memory. I was in the same English section with Joe in 1938 when we were studying drama, one of two sections which put on performances of *The Petrified Forest*. In our section Joe was Duke Mantee, Bogart's role in the movie. Joe was outstanding, a very believable Mantee, thoroughly portrayed.

"As upperclassmen we were both Engineers Advanced ROTC, drilled and took the same military courses together, and attended 1940 engineers summer camp at Fort Belvoir, Va. After graduation I did not see Joe again until 1952 when Pan Am ordered a new fleet of DC6-B aircraft to inaugurate a new class of low-fare service across the Atlantic."

Bob goes on to remember working with Joe, whose company Thermix Corp. was selected by Pan Am to provide "a new concept of seating for these airplanes." When the project was completed and a great success, Bob and Joe celebrated with a fishing trip off Montauk Point and a great haul of blues and seabass. The two classmates once again renewed associations in 1966 when Bob was Pan Am's representative at Boeing for the launch of the 747 and Joe's company was selected to build yet another new concept in seating for the new wide body aircraft. Some of you may have seen the anniversary celebration of this first commercial flight of the 747, January 21, on CBS.

Your secretary can not add to these old airplane stories but can remember playing the role of "Boze," the football player cum gas station attendant, in a competitive production of the *The Petrified Forest*, that same year. I was so worried about my part that I can't remember who played Mantee. "Gabrielle," the Bette Davis role, was played by a young instructor's wife, due to the shortage of co-eds.

The solution to my pilgrimage mystery was hidden in Bob's appended, four-page, single-spaced report of his three-week trip to France and Spain in June 1994. This commenced with a three-day Falcon Operators' seminar (another Pan Am connection) at Dassault-Falconjet in Bordeaux, France. After visiting some of his old haunts established during his stint as a Pan Am rep in Bordeaux in the 1960s, he rented a car and, with trusty traveling companion Mary Sanford, visited Lascaux where he found the famous caves with their primitive paintings now closed to the general public. A nearby replica is open and faithful to the original. Returning to Bordeaux, they proceeded (four days) on the thousand-year-old pilgrimage trail, along the north coast of Spain to the western corner at Santiago de Compostela. This was and is the destination of pilgrims, and the source of Bob's Christmas card. The remaining two weeks were spent on a circular route through northern Spain (including Madrid), riding the TRV, a high-speed train from Bordeaux back



ClassNotes

to Paris, and many visits to old friends along the way. In addition to his Pan Am contacts, some friends date back to the 1930s when Bob's family lived in France and Spain.

Ralph Hunt of Alexandria, Va., called me to inquire about my new e-mail address (see below). In the process he reported his recent return from a MIT sponsored, two-week, cruise through the Panama Canal from the Caribbean to the U.S. west coast.

As scheduled, **Chet Hasert** went into Fair Oaks Hospital for a left hip replacement on January 30. He was home in four days, is recuperating with flying colors, and expects to return to most activities in six weeks.

Now for the sad news, which unfortunately seems to arrive in batches: MIT has just learned that **Richard C. Collins, Jr.**, passed away in 1967. There were no other details. Until recently, he has been listed in MIT directories as living Saratoga, Calif., and working as a tooling supervisor for General Motors in Fremont, Calif. Class lists show him to be affiliated with Course II and the DU fraternity. He was not listed in our 1941 *Technique*.

Richard Haven, '50, and **Larry Turnock**, pass the word that **Carl L. Goodwin** died of pneumonia on November 28, 1994, after battling Parkinson's disease for several years. Carl was a metallurgist , member of Phi Gammma Delta, Alpha Chi Sigma, the Radio Society, Nautical Association, and the Gym Team while at Tech. The biography he submitted for the 50th Reunion, which he did not attend, indicated that he worked with ALCOA, in Cleveland, Ohio, from 1941–1966. He then worked for ALCAN in Warren, Ohio, until 1970, when he transferred to their plant in Oswego, N.Y., where he was in charge of metallurgy. He retired to Flagstaff, Ariz., in 1973, moving to Oregon in 1985. He is survived by his wife, Marie, three children, and seven grandchildren. Marie continues to reside at 31486 Old Farm Rd., Wilsonville , OR 97070.

MIT was also informed that **Gardner M. Ketchem** had passed away on September 25, 1994. They had no details but listed his address as Alexandria, Va. His son, Richard G., of Alexandria informed me that Gardner had died in Schenectady, after apparently good progress following a heart bypass operation. His wife, Marion, alive at the time of our 50th, died a few years ago. Gardner was in Course II, the ASME, and Freshman Heavy Crew at MIT. He remained at MIT after graduating with an SB, receiving an SM later that year, and an ScD in 1949, all in mechanical engineering. As he says in the 25th Reunion book, with the humor I remembered when I was a member of the same freshman section, "Weak eyes and a large stomach kept me out of the service!"

Fate (and the alphabet) threw us together then, in 1937, and over the years, with adjoining pictures in the *1941 Technique* and in the 25th and 50th Reunion Yearbooks where Gardner described his career to include work as an engineer with General Electric Co., and positions at Union College that included professor and chairman of the Mechanical Engineering Department, chairman of their Engineering Division and faculty trustee. Gardner was active in various committees of the ASME. He was also an active church member and trustee. He retired in 1985, continuing his hobbies of photography, golf, bridge, and travel. He is survived by his son and three grandchildren.

Larry Turnock also writes that others of his Phi Gam friends are in mourning. **Bill Hooper's** wife, Evie, died of heart failure on November 9, 1994. **Johan Andersen** followed on February 1, 1995. I expect to receive more information fabout Johan from MIT which I will report in July issue. I'm sure that all members of the class express their sympathy to Bill and his family and to the families of our departed classmates.

Sepp Dietzgen sends New Year's greetings and writes that he is slowly getting used to his new "Haus." He was recovering from a "busted" knee caused by "too much tennis." His wife, Peg, after being diagnosed with a life-threatening illness, went to Mayo Clinic where their daughter is a surgeon. There Peg was given a reprieve. What proved to be ulcers, caused by *H Pylori* bacteria, was treated with antibiotics for a rapid recovery! They are very thankful for this relatively new medical discovery. Sepp is continuing to investigate with MIT **Sterling Ivison's** proposal to hold our 55th Reunion at Martha's Vineyard.

At Christmas time your secretary was dragged kicking and screaming into the information age when son Andy presented him a big fat book of instructions and the software for *America On Line*. Those of you with access to the Internet can send e-mail to me at the address below. The "handle" was generated when five-year-old Phoebe, after being referred one too many times to her grandfather for answers to things aeronautical or astronautical, said, "There's the old Spaceman!"—**Charles H. King, Jr.**, secretary, 7509 Sebago Rd., Bethesda, MD, 20817-4839; e-mail: <olspaceman@aol.com>



FROM THE PHOTO ALBUM OF BOB (WALLACE) BLAKE, '41:

At left is the Hotel San Marcos in León, Spain, a parador built by Carlos I in the early 16th century as a hostel for pilgrims to Santiago de Compostela. "It still performs this function elegantly," says Bob. At right he is joined by his traveling companion, Mary Sanford, in front of a ceramics shop in Santillana Del Mar.

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Joe McHugh is living in Watertown, Mass., and reports that he is "still with the low-tech family business, W.J. Grosvenor Co., in Medford." Daughter Anne is married to Howard Shrobe, a Yale graduate, but with an advanced degree from MIT. Guess that makes everything okay!

Jean and I, wintering as usual in Clearwater, Fla., have been visited by Mimi and **Jim Stern** when they were spending a few months on Long Boat Key, just a short ride south of us.

One belated obit to report: **Herman Lorence**, graduated in course XVI, was retired and died in Brookings, Ore. Our sympathy goes to his family.

We appreciate all of you who say you enjoy reading the Class Notes. But only you can keep them interesting by sending news!—**Ken Rosett**, secretary, 281 Martling Ave., Tarrytown, NY 10591

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It's a great month—several notable news items and no obits. . . . **John H. Upham III** (Course I) is enjoying retirement in Brentwood, Tenn. Treasuring fond memories of the 50th Reunion, he awaits the 55th with anticipation. . . . As chairman of the New Canaan, Conn., High School Building Committee, **Hamilton Herman** (Course XVI) has organized and managed a $6 million rework of the school facilities. This project cleaned up asbestos hazards, installed modifications to meet handicapped access regulations, and upgraded fire safety provisions in compliance with a more rigorous code. For his efforts, Hamilton received the applause and gratitude of the New Canaan School Board.

Barbara and **Herb Twaddle** (Course X) sent copies of their 1993 and 1994 Christmas newsletters from Arlington Heights, Ill. The earlier missive is full of colorful detail about the family wedding in Pisa, Italy (reported in previous Class Notes), and a tour of Scotland. In 1994, their new Italian daughter-in-law presented them with a grandson, and also qualified for a three-year residency program in internal medicine at Evanston Hospital. Other Twaddle chil-

dren have careers in medicine and education. The elder Twaddles continue their travels, touring the Canadian Rockies and visiting New England. In her spare time, Barbara works as a church librarian and Bible study leader, while Herb serves as a hospice volunteer and "piddles with electro-mechanical gadgets." A flagrant example of family values.

A Christmas message also came from Marion and **Gilbert Monet** (Course X) in Willow Street, Pa. They live in a life-care retirement home near Lancaster. Marion has gone through a second year of Chronic Fatigue Syndrome, sleeping about 16 hours a day. She hopes that specialists at Hershey Medical Center will find ways to shorten the prospective three additional years of recovery time. Gilbert has bought from a local car museum a 10-year-old Buick sedan showing a 72,000-mile history. It is, however, "loaded with extras and in mint condition." He uses it to reduce wear and tear on his '93 Dodge Caravan. Sad to report, his usually burgeoning garden has suffered recently from plagues of rabbits and mildew. He is in the process of converting it to perennials.

Thank you, one and all, for your notes. Keep them coming.—**Bob Rorschach**, secretary, 4727 S. Lewis Pl., Tulsa, OK 74105-5138

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It is just about a year ago now that we celebrated our grand 50th reunion. Shortly after the reunion, our class president, **Ed Roos**, participated in the MIT Alumni/ae Travel Program trip to Normandy and Loire, France. Eliza Dame of the Alumni/ae Office (with assistance from her husband, Doug) was the trip coordinator and did an excellent job in arranging and supervising the activities. A visit to Chartres and its famous Cathedral was followed by a bus tour of the Loire Valley. From Tours they visited the Loire chateaus Chenonceau, Chambord, and Blois and later the gardens at Villandray. The visit to Normandy and the invasion beaches was very symbolic for Ed. With the sight of the beaches and cemeteries in mind, Ed felt that all of us who missed the invasion should be very thankful. The area was full of war museums with a rather large one at Caen that portrayed the history of totalitarianism in Europe. At St. Mere Eglise was a special parachute regiment exhibit with gliders, etc., plus a dummy hanging from the local church spire as did a real paratrooper on D-Day. At Bayeau was the wonderful tapestry depicting William the Conqueror's family history and defeat of Harold at the battle of Hastings in 1066. Ed recommends the trip to anyone if it is ever offered again as being an interesting and fun-filled experience.

We regret to report the passing of several classmates. **Melvin L. Milligan** passed away in New Milford, Conn., on November 28. Mel was a retired lawyer and dealt in rare books. World War II interrupted his studies at MIT as he served in the Army Air Corps as a weather officer. After the war he attended Harvard College and graduated from the Law School. He is survived by his wife, Elizabeth, two sons, three daughters, and eight grandchildren.

Stanley W. Warshaw, our class co-treasurer, passed away on December 20 in Newton, Mass. Details in a future issue. **Andrew F. Corry**, our recent co-secretary, passed away on December 22 in West Hyannisport, Mass. Stan's and Andy's funerals were attended by **Les Brindis, Frank Chin, Lou Demarkles, Norm Sebell**, and their wives.

Andy was an international management consultant and a retired senior VP of Boston Edison Co. He was the husband of Diane Kinch Corry. His first wife, Mildred (Dunn) Corry, died in 1977. He was a graduate of the advanced management program of the Harvard Business School at Harvard University. After retiring with 36 years of service at Boston Edison, he started his own consulting firm, Corry Associates. He was an internationally recognized expert in underground electric transmission and distribution systems and was elected to the National Academy of Engineering in 1978. He was a registered professional engineer in Massachusetts. Andy was a member of the MIT Club of Cape Cod and the Harvard Club of Boston. He volunteered his time and expertise to National Research Council committees and as chairman of a review committee for the U.S. Department of Energy research program. Besides his second



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wife, he is survived by a son, James Corry of Houston; two daughters, Andrea Kantaros of Peabody and Janice Luongo of Wakefield; a step-daughter, Melissa Tritter of West Hyannisport; a sister, Trudie MacFarlane of Salem; and five grandchildren. One of Andy's claims to fame was his "Corryisms." "Bless'd is he who has but one set of numbers, for he shall not be confused; Paralysis by Analysis; Needs have a way of being met; Be Proactive; First Law of Forecasting: Early and Often; First Lesson in Law: Find who has the money and sue!; When I get the urge to exercise, I lie down until it goes away; Don't make the patient worse." Above all else Andy was a gentleman and scholar. He will be missed by the co-secretaries who served with him in the Army in basic training and OCS. Reunions will not be quite the same anymore without Stan and Andy who both served the class faithfully for so long. The Class extends its sympathy and condolences to the families of our departed classmates.

Please send in items of your activities.—Co-secretaries: **Frank K. Chin,** 221 St. Paul St., Brookline, MA 02146; **Louis R. Demarkles,** 77 Circuit Ave., Hyannis, MA 02601

45 50th Reunion

It is here at last! Yes, 1945's 50th Reunion celebration will start at Commencement on June 9 and will have its finale—a Walker Memorial Dinner Dance—on June 16.

Between these dates, we will be renewing our acquaintance with Boston and vicinity (my, but it has changed in 50 years!) before journeying to Prouts Neck, Maine, to enjoy the hospitality of Black Point Inn.

On June 15, it is back to Cambridge for a reception at President and Mrs. Vest's, Tech Night at The Pops, plus a most exciting and invigorating Technology Day.

Yes, a time for us to review friendships not only with our fellow classmates but also V-12ers, as well as many others in the Classes of '43 through '49.

There is always room for a wayward individual. If you have not made reservations and still want to join in our festivities, please immediately call Eliza Dame at (617) 253-8230 or yours truly at (603) 436-8458.

We look forward to seeing you in Cambridge and Prouts Neck.—**Clinton H. Springer,** secretary, Box 288, New Castle, NH 03854

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Well, to quote our **Bob Nelson**: "It's Christmas-letter writing time again. Letters and cards are coming in everyday now, and it is great to read about all the different things we've being doing." Bob and his wife, Marianne, finished their new house last March and, shortly after, he had his right hip replaced. His first walk outdoors with crutches was in April. He went on to walking two miles and then he was on his bike as far as 17 miles by September. In January, Bob and his wife traveled to an assembly of the Unitarian Universalists Association in Fort Worth and later to Paris. For the past two years, Bob has been treasurer of the Lompoc Museum which informs about the Chumash Native Americans who have lived in the area from San Luis Obispo to Ventura, Calif. Also, Bob relates some excitement last October when young boys started a fire near their home. Fortunately the fire engineers were able to put the fire out in several days.

Another Christmas letter came in from Elaine and **Roger Bart** who writes poetry and tells about a lot of grandchildren. They also tour around the Beaufort branch of USC to "obtain more education, both on European history and South Carolina's role in our nation." Also, "when losing anchor in a storm and more disaster near, the Coast Guard quickly responded; *Aries* did not hit pier, but we got less help from the Guard on one very foggy morn."

As I was writing this I got a letter from one of our V-12ers to my surprise as I haven't heard from him for years. He is **"Smie" Buckman** who (posted as Sea Island) lives in Florida. He sent me a copy of an MIT *Connections* (which I've never seen) telling of the work that **Robert Fried** has been doing on the MIT Club of Westchester, N.Y. Bob lives in Kingston, N.Y.

That's all, folks.—**Jim Ray,** secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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We'll start off this month with a delightful letter from **Leon Schwartz**: "I am turning 71 and am entering my third childhood. This summer I started learning to ride a motorcycle and ended up with three: one to practice (Honda CL 360), one to drag a bit (Honda CB 650), and one to do cross-country (Honda GL 550). When I was in my second childhood (a year and a half ago), I built an experimental airplane with wheels, skis, and floats. I can carry passengers but no one is crazy enough to take up my offer."

Summarizing the rest of the letter, Leon tells us he taught work simplification, continuous improvement, and total quality control to factory managers in China in 1986 and 1988. Since then he has lectured in Mexico, Guatemala, and Israel, and in the U.S. He and Marge have also traveled extensively. They were fortunate enough to cruise up the Yugoslavian coast just before the war. Last year they cruised up the Norwegian coast, ending up 500 miles north of the Arctic Circle. (Ann and I will be doing that cruise this summer.) He also tells us that Marge is doing structures out of scrap metal so they stop at every scrap yard they see looking for "that ideal piece."

Ed Cavanagh brings us up to date. He retired from ITT-Cannon Electric in 1977 and bought Precision Babbitt Co. in late 1978. Over a period of time he sold that company to the employees and retired in 1994. He and Skip celebrated their 50th wedding anniversary with a delightful cruise from New Orleans to Natchez aboard the *Mississippi Queen* in February 1994. Sadly, Skip succumbed to cancer in June.

Ed Kane now is in his ninth year of consulting work. Jackie just retired from the Hartford Board of Education after 43 years. Ed and Jackie also keep busy with five grandchildren. . . . From **Aaron Newman**: Last year he took a one-month trip to China, Hong Kong, Bangkok, and Singapore. He says the trip was very exciting—but exhausting!

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William J. Dalton, '80
Craig A. Stephens, '78
Richard Park, Jr., '81
Michael C. Miller, SM '84
Thomas W. Mullen, '86
Todd Sjoblom, '75
Kim Sklar Reichelt, '88
Carl G. Bespolka, '83
Sharon A. Els, '88
Thierry Chevalley, SM '91
Donna D. Mayo, SM '93
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Kenneth L. Recker, SM '73
Mark X. Haley, SM '75
Robin B. Dill, '77
Andrew F. McKown, SM '78
Keith E. Johnson, SM '80
Elliott I. Steinberg, SM '80
Gretchen A. Young, SM '86
Alec D. Smith, PhD '89

We just go word that **Paul Kiefer** died in January 1994 in Annapolis, Md. Paul was a professional engineer who worked for Westinghouse for 40 years until his retirement in 1993. In 1968 he received the American Institute of Aeronautics and Astronautics award for outstanding contributions to the country's space program. He was selected for his work on the Gemini rendezvous system and the development of a lunar television camera for the Apollo space flights. He was the first engineer at the Westinghouse plant to receive the AIAA award. He is survived by his wife, Sheila; three sons: Bruce of Charlottesville, Va., Donald of Warrenton, Va., and Thomas of Phoenix, Md.; and three grandchildren.

Ralph Strawn died in April 1994 in Malvern, Pa. He worked as a manager at General Electric Space Systems in King of Prussia, Pa., for 39 years, retiring in 1989. He is survived by his wife, Barbara; two sons: Ralph, Jr. of Gadsden, Ala.; and Robert of Mountain View, Calif.; and one grandchild. . . . We also received word that **Peter Poulos** died in December. He was living in Maplewood, N.J., and is survived by his wife, Helen. We have no other details.—**R.E. "Bob" McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Henry Warner has retired from daily activities on the floor of the American Stock Exchange. Using a satellite dish and the electronic information highway, he is still active from his home. . . . **Bill Hoseley** is active in the MIT Club of Rochester, N.Y. The Club had a reception at the opening of an exhibit recognizing the strobescope work of Doc Edgerton, '27. Chairman Paul Gray, '54, and Mrs. Edgerton attended the event. Bill and other club members worked with the Eastman House staff to enhance the MIT connection. Eastman House was founded by George Eastman, aka Mr. "X," whose mega-gift made it possible to erect the main buildings of MIT for the 1917 move from Boston to Cambridge. . . . **Bernard Devins** moved to a retirement home. He compared the move to his role in amphibious invasions in the Pacific during WWII. He found the recent move more traumatic. His memory of seeing so many good men die during the invasions still gives him feelings of guilt.

Ted Thal has retired from his position as principal electrical engineer at Parsons, a large electrical contractor. He and his wife are preparing their house for sale. They plan to move from Pasadena to Orange County, which is closer to their two baby granddaughters. . . . **Julian Taub** is building his consulting practice. Current clients include an upscale decorative hardware and bath retailer, a coffee and expresso bar company with 40 cafés in three cities, an art poster wholesaler, and two shopping center developers. . . . **Jerry Jarrold** died from leukemia at the age of 72. Jerry was born in Brooklyn and grew up in San Salvador, El Salvador. He owned and operated a manufacturer representative firm for many years. He was an avid sailor, photographer, and champion swimmer. His son, Bill, was MIT Class of '89. Jerry and his wife, Mary Francis, had been living in Easton, Conn., for the past 25 years. On behalf of our classmates, I extend our sympathy to Mary Francis and her family.—**Marty Billett**, secretary, 16 Greenwood Ave., Barrington, RI 02806; (401) 245-8963

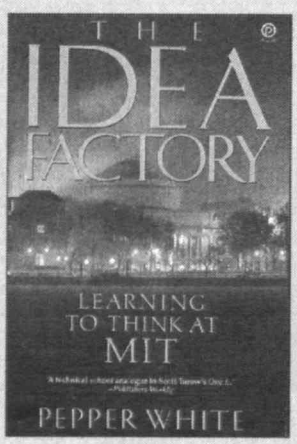
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Last year, **Ken Prytherch** told me on the phone that he was off to Ethiopia but didn't explain why. I regretted that I hadn't asked. So, in the July 1994 issue of this magazine, I did ask. Now, from *Tanzania* (!), comes Ken's answer in the form of a 4x6 color print (presumably taken by him) showing the back of a late model Cadillac bearing the vanity plate MIT 49. On the reverse side of the card, Ken writes: "You asked what I was doing in Ethiopia. The same reason I am writing from Tanzania. I'm trying to find the owner of this car and why he is driving it in Africa." (Secy: Glad you cleared that up, Ken.)

John R.M. Alger writes: "My original class was 2-48 as accelerated schedules were still in force after the big war. Classmate Marshall Baker of 2-48 (he actually finished then!) and wife, Betty, came by for a visit. He threatens a reunion of the 2-48'ers! My son Monty, '78, is still progressing with GE and now is in their plastics business. His wife, Ann, is expecting our fourth grandchild. At five months, she says it's a boy. Modern (medical) technology makes a big difference."

In a letter to Bill Hecht, executive VP and CEO of the Alumni/ae Association, **Jim Veras**

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writes: "Dear Bill, After a hiatus to mourn the passing of my dear wife, Gary, I am regenerating interest in a variety of activities. MIT and its support as an alumnus has always been a top priority. I want to rejoin the ranks of the Great Dome Associates and eventually resume giving some of my time to fund-raising. At 69, I am fully employed and very busy with work that is also helpful to global environmental management. Given good health, I have no plans to change my methods." (Note: In the N/D 1990 issue of *Technology Review*, this column contained a moving account of Jim's work with the World Environment Center, Inc., of which he is executive VP.)

Bill Lewis is the innkeeper and owner with his wife, Barbara, of The Chase House in Cornish, N.H., a bed-and-breakfast inn which was the birthplace of Salmon P. Chase, 1808-1873, Secretary of the Treasury and Chief Justice under President Lincoln. The inn is a National Historic Landmark. Throughout most of his career, Bill has been a vertical transportation engineer with Otis and Payne Elevator companies among others. He has managed elevator projects in high-rise buildings world-wide. He wrote the chapters on elevator design in the *Building Structural Design Handbook* and the *Materials Handling Design Handbook*. Bill is a member of numerous professional and civic associations.

At our 45th Reunion last June, **Emilio Venegas** suggested that we plan a mini-reunion in 1996 down on his island of Puerto Rico. No dissenting voices being heard, your reunion committee is taking very seriously this smashing idea of Emilio's. We will keep you posted.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192; (617) 449-1614

50 45th Reunion

The large type above again proclaims that this is our reunion year. I write this in early February, but you should receive your issue around May 1. And May 1 is near the deadline for registering. Come on, you undecideds! Send your check.

Helmut Weber writes from San Diego that John Wiley & Sons has just published his new book, *Shock Wave Engine Design*. Congratulations, Helmut. I am sure your classmates will all buy a copy. . . . Class President **Bob Mann** gave a talk as part of the "Biomechanics Bash" (I am not making this up) at the Orthopaedic Research Lab at the Good Samaritan Medical Center in Palm Beach. His talk was titled, "How a Brooklyn Draftsman Became an Orthopaedic Biomechanician." The local paper quipped, "Yes, this is an MIT alum's idea of a good time." I am sure you are all familiar with Bob's pioneering work on biomechanics. The MIT Club of the Palm Beach Region joined Bob at a cocktail reception beforehand. . . . Another MIT Club item reports that **Jim Hooper** is the membership VP of the three-month-old MIT Club of Orlando. The club president is **Lionel Goldring**, who received a PhD from MIT in 1950. We are happy to have him claim membership in our class.

Dan Flanders called from Biloxi to say he plans to attend our reunion. Dan retired from Ingalls Shipbuilding, where he had labored for 24 years, in January. Previously, he had spent five years as an Air Force pilot and 15 years with General Dynamics. He and Ginny plan to enjoy sailing and other retirement fun right there on the Gulf Coast. They enjoyed a trip to Paris last year.

This month brings the sad news that **Ralph Hall** died of lung cancer on December 10. It was only in the January '95 issue (using the first name Bill, which he seemed to prefer) that I wrote of his remarriage and move to Florida. Alas. . . . Word also reached me that **Larry Marks** died in 1994. He lived in Falls Church, Va., but I have no further information.—**Robert A. Snedeker**, acting secretary, Seven Mashie Way, North Reading, MA 01864; **John T. McKenna**, secretary, P.O. Box 146, Cummaquid, MA 02637

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In June, Radiation Systems, the company that **Hal Siegel** was with for 27 years almost since its founding, was purchased by Comstat Corp. Hal is continuing as VP, Office of Law and is attempting to integrate the two operations. Hal's wife, Valerie, using a Bar Association grant, is developing a drug program for use throughout Maryland. The program trains pairs of doctors and lawyers to go to middle schools to orient the children to the physical effects of drugs and the legal implications of substance abuse. For recreation, Hal vacationed by taking one of his daughters and two grandchildren to Antigua. At home he is involved with gardening, attending theater, and restoring an old 1960 26-foot wooden boat.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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With admirable dispatch, 45th Reunion chairman **Stan Sydney** has named the time and place for our next reunion: the weekend of October 24, 1996, at the Hershey Hotel, Hershey, Pa. We are encouraged to keep this event in our plans for the future.

Ray Loomis is thinking about the future. He has created and is marketing the "Checkchess RoundBoard," a checkers and chess board with only two boundaries instead of the conventional four boundaries. He says that this "evolutionary" change in the board is expected to replace the present square board sometime in the 21st century, but he does not say who expects it. Ray's note sets my mind working: I surmise that the playing area is an annulus, and that checkmate with only a king and a rook would be problematical. However, I will put off worrying about this for the next hundred years, which is my idea of planning ahead. . . . **Gerald Cohen** is a museum docent for the Santa Monica Museum of Flying, and he serves on the MIT Educational Council in Los Angeles. He is retired from Hughes Aircraft Co.

I am very sorry to report that **David Crocker**, who helped plan our 40th Reunion, died last November 9. Dave left MIT to serve in the Signal Corps during the Korean War before returning to MIT to graduate. He was retired from the Draper Laboratory, where he spent his entire career. Dave is sur-

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Geoffrey Bentley, '58, received the 1995 Aerospace Contribution to Society Award from the American Institute of Aeronautics and Astronautics in January. The award honored Bentley "for over 30 years of outstanding aerospace contributions in technology, program management, public policy, and defense conversion." He is manager of business research for Textron Defense Systems (formerly Avco) in Wilmington, Mass. As a Congressional Fellow to then-Congressman Paul Tsongas and the New England Congressional Congress, Bentley developed and coordinated renewable energy policies. He has also been a fellow at MIT's Center for Advanced Engineering Study, where he focused on methods to improve product quality, productivity, and competitiveness; and he has written numerous professional papers.□

vived by his wife, Roberta, two sons, a daughter, and three grandchildren. . . . I also regret to say that **William Quinn** died on March 10, 1994. I have no more information about him.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301; e-mail: <lacey@hpl.hp.com>

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Regrettably, I have received no class news from any of you folks since my last column was written, some six weeks before this one. Thus, once again, I am left with only two (rather lousy) alternatives, to wit: submit no column for this issue or extemporize. I am opting for the the latter.

Just before Christmas, Kay and I went to Phoenix for about a week and were hosted and entertained by my youngest son and his wife. One special treat was a two-day trip to Sedona, Ariz., a small resort town whose claims to fame include: 1) its proximity to some spectacular red rock formations; and 2) its Los Abrigados Resort which celebrates the holidays with its annual "Red Rock Fantasy," a dazzling and mind-boggling display of a million sparkling lights grouped in more than 50 exhibits along a scenic walk that winds throughout the 22-acre village-style resort. And, yes, the "Fantasy" *is* open to the public.

By the way, for those of you who live in very-high-rent areas (such as Boston, San Francisco, Los Angeles, New York, or Washington) and are looking for pleasant and attractive locales with reasonably priced residential areas, I recommend taking a look at the Phoenix region.

Do pardon me if I brag a little (and perhaps please **Howie Stern** as well) by telling you good folks that after 46 years of two-to-three-packs-a-day smoking "yours truly" has kicked the habit.

That's all folks!—**Martin Wohl**, secretary, 4800 Randolph Dr., Annandale, VA 22003; (703) 354-1747

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The usual holiday letter from New Hampshire, written by Crathern, the cat who runs the lives of Catherine and **George Schwenk**, arrived late this year, so we are late in reporting the Schwenk's 1994 activities. George is still very active with the Boy Scouts and led an expedition of 15 scouts and leaders to Russia last summer, visiting Moscow, Saint Petersburg, and the first International Russian Scout Jamboree. Back here, George is still buying and selling small companies to keep busy, while Catherine has plunged into horticulture, wildflower societies, and garden shows. . . . We have received word that **Creighton Cook** died last August in California. After serving in the U.S. Navy during World War II and the Korean War, Creighton received a master's degree with our class. He continued his career in the Navy and was commanding officer of the aircraft carrier USS *Kearsarge* during the Vietnam War. After retirement in 1973, he remained active helping to design advanced maritime patrol aircraft. Our sincere sympathy goes to his wife, Betty Jean, and their children and grandchildren. . . . A number of you have been asking about the Fortieth Reunion Class Book, wondering where or if it is. The answer is that it will be in the not-too-distant future. It has been the victim of delays not uncommon when volunteers take on a big job, but the editors have rallied and we will keep you posted as progress continues.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430

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40th Reunion

Charles Ladd reports that in May 1994 he was the first recipient of MIT's Samuel M. Seegal Prize for "inspiring students in pursuing and achieving excellence," and in July became the Edmund K. Turner Professor of Civil and Environmental Engineering. He has completed his term as chair of ASCE's Geotechnical Engineering Division Executive Committee. He also was the U.S. delegate to the 13th International Conference on Soil Mechanics and Foundation Engineering in New Delhi, which lead to lectures in Bangkok and Taipei.

Paul Ben Coggins is happy to report that the Pass-a-Grille Church Tutoring Clinic has received its third consecutive Prudential Insurance Company "Community Champions Award." This award is given annually for outstanding volunteer service. Paul has served as head Mathematics Tutor continuously since 1978, working with hundreds of children and adults from elementary school to college level. The Clinic, currently with about 12 volunteer tutors in math and in language arts, serves much of Pinellas County, Fla.

We look forward to seeing you at our 40th Reunion!—Co-secretaries: **Roy M. Salzman**, 10643 Montrose Ave., Apt. 2A, Bethesda, MD 20814; **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21042

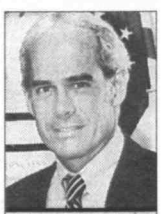
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Nicholas J. Kiladis reports that he is still running the Computer Division at the Maryland Mass Transit Administration. Also, youngest daughter Lia, a Yale graduate, is currently in her second year in the MIT Graduate School of Architecture.

Send news to co-secretary, **Ralph A. Kohl**, 54 Bound Brook Rd., Newton, MA 02161; e-mail: <kohl@ll.mit.edu>.

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Please send news for this column to: **John Christian**, secretary, 7 Union Wharf, Boston, MA 02109



Woops! Old habits die hard.... In April we inadvertantly identified John Porter, '57, the new chair of the House Appropriations Subcommittee on Labor, Health, & Education, as D-Ill., when he is, of course, R-Ill. Our apologies!

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A profile sheet in this month's mailbag summarizes the career and accomplishments of **Melford (Mel) Monsees.** After receiving a general management degree, he spent 38 years with the U.S. Army Corps of Engineers followed by association with a consulting engineering firm. Concurrently he served as coordinator of the University of Missouri/Columbia Graduate Engineering Program in Kansas City. Mel developed this program in which over 600 students earned advanced degrees and administered it for 20 years. He has received many awards including the Meritorious Civilian Service Award from the chief of engineers, Washington, D.C. He has also served on the MIT Educational Council, published several

papers, articles and book chapters, and has traveled extensively.

Richard Hornreich died in his sleep October 24, 1994, according to a brief note received from the Weizmann Institute of Science, Rehovot, Israel. At the time of his death he was professor in the Department of Complex Systems. In addition to his undergraduate degree in Course VI-A, Richard also received advanced degrees in electrical engineering from MIT in 1959 and 1961. No other details were provided.

News from **Dick Barone** indicates he has been attending classical, country, and oldies concerts all over New England, made especially enjoyable since he won many of the tickets. He and Peg camped during some of the concert trips. Their three sons are all in college, Rich at Bridgewater State, Paul at Boston University Medical School, and Tim at Providence College. Dick concludes by noting that it won't be long before the reunion committee gets back to work!

Robert Rose is listed among the MIT faculty members who moved from the editorial board of the defunct *Journal of Irreproducible Results* to a similar position with the new *Annals of Improbable Research* (AIR) now being published by the MIT Museum. As described in the MITnews section of the F/M 1995 *Technology Review*, these dignitaries are accorded the status of "AIR-head" for their loyalty! The article noted that the editorial board numbers 40-odd ("some *very* odd") members, including seven Nobel laureates and four MIT faculty members. Pretty impressive company, Bob!

Although we don't have any such distinctive accolades to bestow upon contributors to this column, your communiqués are vital. Suggestions for ways to recognize and reward such endeavors should be sent to —**Gary Fallick,** secretary, 4 Diehl Rd., Lexington, MA 02173

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Please send news for this column to: **Dave Packer,** secretary, 31 The Great Road, Bedford, MA 01730; (617) 275-4056; e-mail: <70421.1766@compuserve.com>

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35th Reunion

Were it not for a follow-up letter I received from **Dick Bradt,** this would have been a no-news month. Dick writes that, in September 1994, he became head of Metallurgical and Materials Engineering at the University of Alabama in Tuscaloosa. Dick had been at the University of Nevada in Reno, where his wife, Liz, will remain through the 1994–95 school year while their daughter completes Reno High. Dick notes that his "presence elevated the football fortunes of both Penn State and Washington to eventually achieve national championships. I foolishly believed that I could do the same for Nevada, but, alas, some goals exceed my finest efforts! I do expect that . . . Alabama will win another national championship in football in the very near future. As I once heard in Nevada: 'You can bet on it!'" I will not take the bet, Dick, and best wishes for much success with the 'Tide.

With my class agent's hat on, I do have good news. You folks have really been making our 35th Reunion year a great one for the Alumni/ae Fund. As of this writing—Happy Valentine's Day!—we are about $200,000 ahead of where we stood a year ago. Many thanks to those who have helped make this a most successful year, and a plea to those who have not yet contributed to do so by June 30, the end of the Fund year.

See you soon at our 35th reunion!—**Frank A. Tapparo,** secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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I'm sorry to report the death of **Jack Jones** last September. We received a note from his son, Andrew, telling of his father's long battle with complications from AIDS and requesting that any contributions in Jack's name go for the benefit of gay and lesbian MIT students. How close this epidemic comes to us all!

Recently a flurry of e-mail messages arrived, reflecting concerns about changes in East Campus. Under consideration is a plan to consolidate all undergraduate housing to the west side of Mass. Ave., which would mean the end of East Campus and Senior House as undergraduate dormitories. The dorms would be renovated to become graduate student housing. As you can imagine, this plan has inspired many irate letters from present and former occupants. (Everyone agrees that renovation is needed, though.) One e-mailer points out how important living groups at MIT are to undergraduate life: a bond between inhabitants is established which lasts a lifetime, and losing the physical basis of that bond is painful to alumni/ae. Many alumni/ae are complaining. Another e-mail message complains about the possible elimination of the Senior House Steer Roast—a May tradition that began in the mid-1960s. The Safety Office seems to feel that the roast is unsafe.

Last winter I met **Jerry Grossman** at a party and we discussed weddings (my daughter, Rebecca, is getting married in June). He reminisced about his wedding: Barbara and Jerry had planned a long engagement and had settled on a June date which was a year away. However, in the dead of winter, raging hormones appeared, and (it being a very different age) the two of them decided to get married secretly in January. Once married, they moved into one apartment and kept their marriage a complete secret from their families. This meant a series of ingenious subterfuges—for instance, Barbara told her parents that she had changed her telephone number because of harassing phone calls. When the planned June wedding arrived, Jerry was confronted with an official New Jersey form asking whether he had ever been married before. He paused. To lie? Shocking! He lied. This disclosure will probably eliminate his chances for the presidency.

A short note comes from **Herb Berman,** who writes that he "left EG&G Rocky Flats, Inc., where I was VP and associate general manager of engineering, project management, and design in April 1994 to join ScienTech, Inc., as manager of engineering and standards management. In August 1994, I joined Mason and Hangger-Silas Mason, Inc., at the Pantex

ClassNotes

Plant in Amarillo, Tex., as manager of engineering and design. My daughter, Cecelia (9), is in fourth grade. My wife, Lelada Lee, has left her banking career to pursue writing essays and short stories." Three jobs in six months and a 9-year-old? Herb must be very healthy. . . . **Marshall Greenspan,** of Fairfield, Conn., writes that his son Mannie is in Boston running a couple of real estate offices. I looked them up in the phone book: NoBull Realty on Massachusetts Avenue and Greenspan and Associates on Commonwealth Avenue. Marshall's daughter, Shelley, is also in Boston, at Boston University, and his other son, Howard, is a product manager at MBI in Norwalk, Conn. Marshall works at Norden Systems in Norwalk. He is proud of his new e-mail address, <cfjm04a@prodigy.com>.

Mike Wiederhold has been director of research in otolaryngology at the University of Texas in San Antonio for the last 15 years. Last summer he put some Japanese red-bellied newts on the Space Shuttle Columbia, and he is collaborating with German scientings in preparing for further Space Shuttle experiments over the next several years, using German snails and Japanese newts. (Some of us liberals can think of another Newt who should be sent into space!) His son, Ted, is a freshman at MIT, which means that Mike's contributions to the Alumni/ae Fund will be reduced for the duration. . . . **John O'Connel** lives in Charlottesville, Va., and he reports that he has completed his term (or sentence) as chairman of the University of Virginia Chemical Engineering Department. Now returned from a sabbatical in Delft, Netherlands, he is back to teaching and research in his capacity as the H.D. Forsythe Professor.—**Andrew Braun,** secretary, 464 Heath St., Chestnut Hill, MA 02167; e-mail: <andrewb820@aol.com> or <abraun@husc4.harvard.edu>

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Thomas P. Sheahen proudly announces that in October 1994, Plenum Press published his new book, *Introduction to High Temperature Superconducting*. Tom says it is a tutorial book, aimed at engineers and scientists who are not familiar with each of the specialties that make up this field.

Just as I was looking for class news, a message arrived from **Tony Mack** across the Internet. Tony lives in Kalamazoo, Mich., but he and Dolores spend a lot of time visiting the Boston area, where their two oldest children live and work. His youngest just graduated from the University of Michigan with a degree in mechanical engineering. Tony works at Fabri-Cal as VP of development and quality, designing and developing plastic packaging and running the company's total quality program, including employee training and supplier and customer partnerships. Classmates visiting Kalamazoo or driving by on I-94 from Detroit to Chicago should give Tony a call, and he and Dolores will show you the sights in the area. . . . Tony read in the *New York Times* that the new owner of Jackie

I CAN READ THAT!
A TRAVELER'S INTRODUCTION TO CHINESE CHARACTERS
by Julie Mazel Sussman, '70, China Books, $8.95

Chinese for Travelers

By Louis Rosenblum, '42

Suddenly, learning to read Chinese signs is no longer the formidable task that most of us reared on alphabets had assumed it to be. Julie Mazel Sussman, '70, has published an easily pocketable paperback that will enable travelers to learn the meaning of a surprising number of common Chinese characters, even if they don't start cramming until they are in the air, en route to China.

This modest vocabulary of 71 ideographs includes such words as "female," "male," "store," "enter," "open," the numbers one through ten, and that critical word for the traveler, "lavatory." With this small number of common words found on signs, currency, tickets, postcards, postage stamps, maps, billboards, and buses, anyone can learn to read dates, signs in the street, and names of several major cities.

The book has a very practical orientation: Americans who would like to know if they have arrived at a school or a factory will find this guide invaluable, since the buildings are often indistinguishable if you can't read the signs. For travelers who know some spoken Chinese, Sussman also gives the pinyin transliteration of the characters. (Pinyin is the official system for representing Chinese characters in the Latin alphabet.) And for the serious cultural adventurer, Chapter 24 offers instruction in how to write these useful word-pictures.



Julie Sussman has written the book that every veteran China traveler will wish that he or she had thought of writing—a 162-page, $9 "best buy." Julie is an experienced author and editor with a great sense of humor and humility. Her experience in two decades of travel and in studying Chinese, as well as nine other languages as disparate as Russian, Japanese, Norwegian, Hebrew, and Serbo-Croatian, has fitted her uniquely for creating and field-testing a book for children through octagenarians.

By using appropriate photographs and background notes, Julie illustrates the wonderful underlying logic of Chinese writing, resolving the (for me) conundrum whereby millions of small children learn to read a language that touring technical people and academics have until recently considered too complex even to attempt.

If you are planning a trip to the Far East and venture into a bookstore with a good travel section, you may find more than a score of books on elementary Chinese. I know, I've bought many of them over the years when indulging my own love of travel and of languages. In my view, Julie's book is not only one of the best for Chinese beginners, but is also one of the least expensive. I wouldn't be surprised if tour companies purchase this volume in bulk to help their clients get the most from a trip. □



JULIE MAZEL SUSSMAN, '70

LOU ROSENBLUM, whose professional activities include the development of multi-lingual typesetting systems and typeface design, has conducted seminars on typesetting systems in China, India, and Greece. He is familiar with the written forms of several Asian languages.

ClassNotes

Kennedy's New York apartment is **Dave Koch**. Tony suggests that we ask Dave if we can have a class party in New York and visit him at the fashionable digs, to view a piece of U.S. history. . . . Tony ran into **Bill Bloebaum** at the airport in Dayton, Ohio. Six years ago they met at LaGuardia; without doing any statistical analyses, Tony guesses that Bill must make his living by traveling through airports. Bill is president of Mead Pulp Sales in Dayton.

Class secretary **Hank McCarl** has just finished his sabbatical in Gloucester, Mass., working on his book, *Energy Conservation Economics*, and hopes to have a publisher soon. He is on his way to Alabama, to assume the office of president of the Alabama Society of the Sons of the American Revolution. Then he and his wife, Mary, will be off to Colorado for a few weeks to attend professional society meetings in Denver and Boulder, and to give a seminar at the Colorado School of Mines. Hank hopes to say hello to **Joan P. Gosink** while in Golden, Colo. Joan is dean of engineering at the Colorado School of Mines. In July, Mary and Hank will travel to Scotland, where Mary will give a paper at Edinburgh at the annual meeting of the Society for the History of Authorship, Reading, and Publishing. Mary's research interests revolve around the history of printing and publishing. She will teach a graduate course next fall at the University of Alabama on her specialty.

If you have access to the Internet, please send your professional and personal news to <MIT1962@mitvma.mit.edu>. Alternatively, you can send a message directly to me at <uabhnm01@asncube.asc.edu>. However, if you still communicate by traditional methods, please send your news and personal notes to **Hank McCarl**, secretary, P.O. Box 352, Birmingham, AL 35201-0352.

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Please send news for this column to: **Shoel M. Cohen**, secretary, Dept. of Psychology, Nassau Community College, Garden City, NY 11530; home phone (516) 489-6465; e-mail: Internet <71271.2627@compuserve.com> or Compuserve <71271,2627>

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Mike Drooker has established a Class of '64 e-mail server, <mit1964@mitvma.mit.edu>*, and **Lita Nelsen** (X, XVA) was the first to use it. Lita is still living in Winchester and is director of MIT's Technology Licensing Office. Husband Don (VI, '61) is at Avid Technology, editing movies! (Actually, deriving the equations for editing the movies.) Daughter Katrina (IX, '91) is in Berkeley and will get an MD from UCSF in June 1996. Son Dan will graduate in industrial design from RIT in June 1995. Lita is still trying learn-to-ski-after-50, and reports the black diamond slopes remain safe from her. . . . **Roger Hybels** and I were both Course II. Roger went on to get an MD at the University of Michigan and I went on to become his patient. (He's a great doctor.) Roger is currently the head of Otolaryngology at Lahey Clinic. Son David who graduated from Franklin and Marshall is currently with Putnam Investments and will go to business school in the fall. Daughter Cynthia is working for the Leukemia Society in Baltimore. Roger and his wife now enjoy spending summers at their "old wooden house" in Gloucester where there is both sailing and many projects.

Michael Hale's youngest child, Stephen, graduated from Drake University in Des Moines. Stephen majored in information systems and graduated magna cum laude. . . . **Mike Auerbach** (V) is still at Pfizer as senior associate director of Regulatory Affairs in Food Science R&D. His son, David, (V, '91) is back at MIT in the TPP Master's Program.—**Bill Ribich**, secretary, 18 Revere St., Lexington, MA 02173; (617) 862-3617

**To subscribe to the 1964 listserver, send e-mail to <listserv@mitvma.mit.edu>; leave the subject line blank, and in the body of the message type* subscribe MIT1964. *Any message you send to the address at the start of this column will go to all subscribers of the list.*—Ed.

65 30th Reunion

Hope you plan to be at the 30th Reunion! If you decide to join us at the last minute, just call the Alumni/ae Office. . . . **Ron Mandle** will be at the reunion. He recently moved after 21 years on East End Avenue in Manhattan, to Madison Avenue and 88th Street. His daughter, Dara, is a sophomore at Yale; his son, Ricky, is a junior in high school. Ron is a senior bank stock analyst at Sanford Bernstein and Co. . . . Also at the reunion will be **Bruce Zottner**, who lives in McLean, Va., and practices patent law in Washington, D.C. After six years in engineering with General Electric, Bruce went to George Washington University to get a law degree and then went into patent law. Daughter Beth is in high school and son Brendan is five years old (quite a generation gap). Bruce has a weekend place at Deep Creek Lake in Maryland and putters around his greenhouse "talking" to his orchids.

I had a great discussion recently with **Marshall Fisher**, who has been at the Wharton School since 1975, concentrating on logistics for products with hard-to-predict demand. His focus is on physical changes to reduce the quantity and time for production: uncertainty equals flexibility. The culmination of his work is an article in the May/June 1994 issue of the *Harvard Business Review* and his election to the National Academy of Engineering for research in logistics (only one of three business faculty to ever get the appointment). He has three children: a daughter who is 24 and married, a daughter who is 22 and in medical school, and a son, 18.

Gene Chase is professor of mathematics and computer science at Messiah College. His wife, Emily, is educational coordinator for the Capital Area Pregnancy Center and focuses on abstinence-based sex education. They homeschool their 17-year-old, Tim; they host foreign exchange students; their 13-year-old daughter, Priscilla, plays the viola; their youngest, John, is into Legos and magic. . . . **Bruce Sunstein** continues to send press releases about great patent cases his firm (Bromberg and Sunstein) has won recently. I hope the reunion gift committee remembers him! . . . **Peter Norris** writes that his new company, NZ Applied Technologies, is doing well, expecting revenues in 1995 of more than $1 million.

Many of you may remember the column I did several months ago on **Bob Goldberg** after his untimely death. I received a most extraordinary memorial to Bob from **Len Lipner** recently in which he details Bob's life, way of thinking, and energy. Len welcomes comments from others in the class, at 9 Kensington Rd., Worcester, MA 01602. . . . I regret to report the death of **Robert Horodyski** in September 1994. He was on the faculty of Tulane University at the time of his death.—**George McKinney**, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167; (617) 232-4710; e-mail: <georgemck@aol.com>

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We have an item of paper mail this month, for a change: **Terry May**, his wife, Robin, and assorted pets moved out of Los Angeles forever and into Greensboro, N.C. He notes that Greensboro was his first choice, other cities in North Carolina second, and anywhere but Los Angeles third. He admits it is a smaller city, but he hasn't found anything lacking except crowding, smog, crime, traffic jams, riots, earthquakes, and forest fires. Having met that lifelong (or at least 15-year) goal they also achieved another; they made the cross-country move in a 33-foot motor home. Their sons are in college—Aaron is a senior at Brown and Jeffrey is a freshman at the University of California/Santa Barbara—so the time was right for a move. Terry is CFO for a mid-sized multi-corporate company with operations across the United States.

Well, that's all the news. Perhaps someone would like to defend California next month?—**Eleanore Klepser**, secretary, 84 Northledge Dr., Snyder, NY 14226-4056; e-mail: <vismit66@ubvms.cc.buffalo.edu>

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Please send news for this column to: Sharlotte and **Jim Swanson**, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024; e-mail: <jswanson@lat.com>

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Please send news for this column to: **Gail** <ghm@nrc.gov> and **Mike** <nmarcus@fcc.gov> **Marcus**, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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Please send news for this column to: **Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304; e-mail: via Compuserve <76570,2270> or the Internet <76570.2270@compuserve.com>

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70 25th Reunion

Please send news for this column to: **Greg** and **Karen Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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I had a great lunch with **Chris Brewster** who is VP and CFO of Sanifill, a rapidly growing, publicly traded company in Houston. Chris has a fine wife and two young children and a new BMW. We had a great time talking about old times. . . . All of us will have a wonderful time talking about old times in the Summer of 1996 when we celebrate our 25th Reunion. Please make plans to come. . . . **Mitchell I. Serota** has had his own consulting actuary business for seven years. He assists the middle market in metropolitan Chicago in their employee benefit needs. His new diversion is wrestling with the Wildcat Wrestling Club (affiliated with Northwestern U.). Peter Haag (Class of '74), also a club member, will be joining him in the "Oldtimer" tournaments this Spring. He says that "learning to wrestle has been the most wonderful midlife crisis imaginable. I've never been in such superb physical condition as I am in now."

Ronald G. Ort now has two daughters, Deborah, 4, and Jessica, 1. He is working for Engelhard Corp., Iselin, N.J., as a patent attorney. . . . **Medhi Jaz Ayeri** writes: "I have moved to Vienna, Austria, as professor and head of the Department of Distributed Systems at the Technical University of Vienna. It is an exciting job and a wonderful city. Our oldest son, Darius, is in the 11th grade and looking at colleges including MIT. This summer we plan to visit the 'Tute. . . . **Greg Bernhardt** is practicing emergency medicine as a member of the Duluth Clinic. He is married with three girls, ages 10, 9, and 6. . . . **Robert D. Marshall, Jr.** writes: "I rejoined the Texas Instruments Patent Department in the summer of 1992 after a six-year sojourn at Krass & Young, a small patent law specialty firm in Troy and Ann Arbor, Mich. I am co-leader of the patent department that supports the digital signal processor and microprocessor design group. My specialty is image processing. On November 15, 1994, I was named a Patent Fellow. . . . I am joining the group of 40-plus people who are trying to get in shape. After six ankle surgeries, I have an ankle that doesn't hurt. I have been riding my bike and doing calisthenics in preparation for a five-day hiking trip this summer with my daughter. I have also taken my 16-year-old son and 12-year-old daughter goose and duck hunting this winter. I also obtained board certification in civil trial law and in estate planning and probate law by the Texas Board of Legal Specialization."—**R. Hal Moorman**, secretary, P.O. Box 1808, Brenham, TX 77834-1808

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Local boy makes good—**Lawrence Bacow** has been elected chairman of the MIT faculty. He teaches in Course XI. . . . **Robert Reiter** writes that "1994 hasn't been all bad. True, my employer since 1980, the IBM Federal Systems Co., was purchased by and merged intact into Loral in February; and the part of the FAA air traffic control contract that I'd worked on for the past three years was terminated summarily (and 'for convenience') in June. But, all three of my kids (fourth, sixth, and ninth grade) made school honor role this fall and the family has been quite healthy all year. The Lord has faithfully met our need and blessed us abundantly in the areas that really count."

I regret to pass on word of the death of **William F. Honda** three years ago. No further information.—**Dick Fletcher**, co-secretary, 135 West St., Braintree, MA 02184

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Please send news for this column to: **Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 7721 Churchill Ct., Marshall, VA 22115; e-mail: <sutton_bob@prc.com>

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Paul Schindler is in the publishing business, and he sent his e-mail message just two days before our deadline, so his news is as fresh as can be. This summer marks his 14th year, on and off, with CMP Publications, a private firm on Long Island that is the nation's leading publisher of computer and electronics newspapers and magazines. Paul has been with *Windows* magazine since CMP bought it in October 1991. Some of you may recall that Paul was editor-in-chief of *The Tech* in 1973 and 1974. Paul belongs to the 50 percent of us who are still married (15 years in January), with two daughters, Marlow (14) and Rae (11), neither of whom showed much interest in MIT when they toured it two years ago. By the way, Paul may occasionally be seen doing software reviews on the PBS show, *Computer Chronicles*. . . . Another classmate who is still married and has been working for the same company for a long time is **Jack Rich**. He has been at Kronos since 1980. Jack and Alice have a son, Garrett (6).

The MacGregor D Entry First Floor residents had a mini-reunion in honor of **Van Dunn**. Unfortunately, Van had to miss the dinner party at the last minute because he was moving from Silver Spring, Md., to New York. Van was the senior health policy advisor for Senator Kennedy and served on Hillary Rodham Clinton's committee to reform the nation's health care system. Although Van was disappointed that the politicians could not pass sweeping health care reform legislation, he was the author of several pieces of medical legislation that did pass during his three-year tenure in Washington. Van's new job will be associate medical director for CIGNA Health Care of New York. The dinner party included **Tom Campbell**, Debbie Orbach, Molly Campbell, Willy Burke, '83, Carol Knowles, Chris Toliver, '73, Larissa Hordynsky, Linda Nelson, and Gene Nelson.

Apparently only the people still married feel the urge to write. Now let's hear from the other 50 percent.—Co-secretaries: **Dave Withee**, 3702 Adams St., Two Rivers, WI 54241-1404; **Barry Nelson**, 65 Hillside Ave., W. Newton, MA 02165-2543; e-mail: <bnelson@smtp.cspi.com>

75 20th Reunion

Please send news for this column to: **Jennifer Gordon,** secretary, c/o Pennie & Edmonds, 1155 Avenue of the Americas, New York, NY 10036, or 18 Montgomery Pl., Brooklyn, NY 11215

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If you have have not done so already, please subscribe to our e-mail server. To do so, simply send a piece of e-mail to <listserv@mitvma.mit.edu> containing the words: *subscribe mit1976*. You will be automatically enrolled. One benefit of being a part of this e-mail network is that it will allow you to be in touch relatively effortlessly with classmates who are widely distributed; another is that we distribute the '76 notes electronically, thereby giving subscribers the news far sooner than getting *Technology Review* in the mail.

On the topic of the mails, e-mail and U.S. Post Office, we have news. **Gregory Malkin** writes, "My wife and daughter are spending the year in Paris—my wife is getting an advanced degree in French translation and my daughter is in the fifth grade. I take a lot of vacations to Paris! My business, in CAE software, continues to grow and keeps me very busy." . . . **Richard Jamison** retired from the Navy, and has started his second career as a senior engineer with Universal Systems, Inc., a professional services company in Arlington, Va. He writes, "I am not only doing ship propulsion engineering, but I am also doing system integration of electronic document image archiving and retrieval systems. My wife, Beverly Ross Jamison, '75, and I had the pleasure of seeing our daughter, Ruth, apply to MIT this fall." . . . **Carl Wales** retired from active duty at the end of 1993, and is now project director of the Alaska SAR (Synthetic Aperture Radar) Facility (ASF) at the University of Alaska, Fairbanks. Carl gives these technical details: "ASF receives, archives, and processes SAR data from the European ERS-1 and the Japanese ERS-1 (currently 47 terabytes of data in the archive). Additionally, ASF is preparing for the delayed launch of ERS-2 later this spring. ERS-2 will use the same processing as ERS-1. ASF is also developing new processing capabilities for supporting the Canadian RADARSAT which is planned to be launched in late summer or early fall."

Through e-mail comes our first note from **Mark Pickerell.** He remained at MIT after graduation, receiving a PhD in 1983. He writes, "After graduate school I entered the U.S. Marine Corps, and spent the next eight months in basic training and infantry school. I then left for Los Alamos National Lab, to work in plasma physics and nuclear fusion. I still work for LANL as a staff member, but no longer in fusion, as the program was cancelled. I now work on nondestructive assay of nuclear materials for safeguards applications, typically in support of the nuclear non-proliferation treaty. We also work on nuclear waste assay for characterization prior to disposal. I was married in 1986 to the former Lee Wynne Schwarz, and we now have three children. Most of my time is spent either at work or with family, as seems the normal lifestyle for many of us at this age. Our family time is spent skiing or hiking, taking advantage of the national forest and mountains that surround us. One of the more exciting parts of the last few years was with the Marine Corps. After basic training and infantry school, I went on to advanced reconnaissance and airborne training. We spent a lot of time jumping out of perfectly good airplanes and helicopters, sometimes with parachutes, sometimes into the ocean. In November 1990, I was mobilized as part of Operation Desert Shield/Storm and served with Delta Co., 2nd ReconBn, 2nd Marine Division. Our unit was at the leading edge of the assault through the Iraqi mine fields, in the Um Gudair oil field in southwest Kuwait. After penetrating the Iraqi mine field we deployed to provide flank security for the 2nd Marine division. The war was over for us in hours. We took a lot of prisoners, much the same as everyone else. Although some Iraqis tried to shoot back, fortunately they could not hit the broad side of a barn."

As for your secretary, I continue to plug along on a variety of fronts. Being in the computer business is proving me with an interesting insight: the industry is cranking out technology far faster than most companies can absorb it. Of course, this makes selling solutions that much more challenging! Please subscribe to our e-mail server, and send news. I can be reached very readily.—**Arthur J. Carp,** secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523; tel: (516) 295-3632, fax: (516) 295-3230; e:mail: <quantalyt@aol.com>

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Please send news for this column to: **Ninamarie Maragioglio,** secretary
9727 Stipp St.
Burke, VA 22015

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News from Alumni/ae Fund Donors: **Eugenia Parnassa-Carroll** sounds like she's keeping busy: "I'm on the faculty at Northwestern University Medical School (Department of Medicine—Cardiology). My husband, John (Princeton '72), and I have four children: Ian (6), Nicholas (4), Adam (1), and Grace (7 months)." . . . **Richard Field** sounds about as busy as Eugenia: "My wife, Donna, and I just celebrated the birth and baptism of our fourth child, Joseph Starbard. I am writing software at NovaSoft systems in Burlington, Mass., <dick@novasoft.com>. I recently saw Olimpio DeMarco, '76. Where's Nino?"

Being a full-service class secretary, I've got direct news from **Nino Pedrelli:** "I am currently obtaining a PhD in business—Department of Real Estate Finance at the UWisconsin/Madison.". . . **Dan Amidei** is tenured in the Physics Department at University of Michigan. He says he "found top quark; still no Higgs, however." . . . **Larry Yablong** and wife Naomi had a baby boy, Akiva, last July in Chicago. Larry says that their daughter is excited and shows no signs of sibling rivalry—yet. . . . **Manuel Casiano** is "still practicing general surgery in small town private practice. Wife Carmen is doing well in gastroenterology. Kids, Chris (9) and Rachel (4), are growing like crazy—Chris had homework to find all prime numbers between 1 and 200, and pretty

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much reinvented the Sieve of Eratosthenes for himself! (What a doting, dad, huh?)" Manuel and family are living in Frederick, Md.

Milton Roye reports a career change: "After 16 years at General Motors, I have found a road less traveled. As VP of sales and marketing, I have joined the management team of one of the 10 largest minority-owned manufacturing companies in the U.S. The challenges will be more immediate and require more rapid resolution than ever before." Milton and family live in Bloomfield Hills, Mich.

Jean Gregory also brings us up to date: "Things are going reasonably well. Funding became somewhat tighter after the German reunification, but there's nothing really to complain about. Once a year I go to the Technical University in Vienna to teach, where I have a guest professorship. There's been a small change in my private life. On Sunday, Sept. 11, I married Lothar Wagner, who is also a mechanical metallurgist."

Brad Schaefer sent a postcard from Hamden, Conn.: "I've just moved to New Haven as a professor of physics at Yale. I'm having great fun with research on gamma ray bursts and supernovae. As for various hobbies, my chess rating has gotten as high as 2130, I can juggle four balls in three patterns, and I've been a consistent third place in North American winks. My wife (Martha Williams Schaefer, '79) has just published (with Guy Consolmagno, '74) an introductory textbook on planetary astronomy. We have a huge new house, along with a nice beagle (Sox) and husky (Grendel) to live in it."

And **Peter Cheimets** faxed some news: "I am still living in Winchester, Mass. I am working for the Smithsonian Institution designing and building telescopes for their Astrophysical Observatory that operates here in Cambridge with the Harvard College Observatory. I have been doing that for over 11 years now. I would love to hear from other MIT folks who have been working in astrophysics or telescope design. My wife, Karen Benedek, is a combustion expert at Arthur D. Little. We have two children, Anna (7), and Chloe (4). They are enjoying the warm winter by wallowing in the mud.

"Claude Von Roesgen, '79, and I decided to expand our interests and collaborated on a movie screenplay about intrigue on the Internet. We finished the first draft in June and entered it in the Massachusetts Screenwriting Contest. We survived the first cut, but not the second. Since then we have been shopping the script around and rewriting it. Mostly rewriting it, since we are better at writing than at shopping the script around (not to say that we are all that good at writing). I added to my meager writing portfolio with an article in the *Mechanical Engineering* magazine in December 1994 on a telescope mirror pointing system I recently completed for a submillimeter array soon to be placed on Mauna Kea in Hawaii.

"**Dave McAllester** set up an Internet mailing list, <burnside@ai.mit.edu>, that reaches a number of old MITers, in addition to Claude, David, and myself, there are **Jenny McFarland**, Michael Graves, '76, Calvin Hsia, '80, Gordon Swartz, '79, and Loren Shure, '77, among others. My direct e-mail address is <cheimets@cfa.harvard.edu> and I would love to hear from anyone."—**Jim Bidigare**, secretary, 9095 North Street Rd. NW, Newark, OH 43055-9538; tel: (614) 745-2676, fax: (614) 745-5648

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Sharon Gardner and Tom Jacobs, '75, recently celebrated their 15th wedding anniversary by having a third baby. Nathaniel Gardner Jacobs was born April 16, 1994, joining big brother Will and big sister Rebecca. They make their home in Salem, Mass. . . . **Steve Simonoff** and his wife gave their five-year old daughter, Cynthia, a baby sister named Stephanie Judith last November 21. Galactic Industries, the software firm that Steve helped to found in 1989, is doing very well and now has 25 employees. They produce chemistry-related software for spectrometers and other instruments. The Simonoffs live in Windham, N.H. . . . **Joel Mattox** and Karen Perizzolo, '82, have been married since 1987. Their son, Jeffrey, is nearly two years old.

Gerald Mata is a project manager in the controller's organization at Boston Edison, working on human resources information systems projects. He writes, "My Course I training is on hold, but not forgotten!" . . . **Clifford Van Reed Ludwig** continues to work as a software engineering manager at Megatest with a focus on software process improvement and memory test software. . . . **Anne Michon Westbrook** enjoys staying at home with daughter Alexandra Michon Westbrook, who was born in March 1991. Anne and husband Scott Westbrook, '78, conceived Alexandra via in vitro fertilization. As Anne sees it, "It seems appropriate that two high-tech people should have a high-tech baby (Class of 2013?).". . . **John (Koegel) Buford** was recently promoted to the tenured rank of associate professor at the University of Massachusetts, Lowell. John joined the faculty of the Department of Computer Science in the College of Arts and Sciences in 1988. His specialty is distributed multimedia systems, including real-time delivery of multimedia information and storage and retrieval of multimedia documents. He edited and contributed a third of the text for *Multimedia Systems*, published in 1993. After graduation, John got a master's degree in Course 6 from the 'Tute and then went on to earn a PhD in computer sciences from the Technische Universitaet Graz in Austria. He lives in Lowell.

That's all for this month.—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

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15th Reunion

Please send news for this column to: **Kim Zaugg**, secretary, 549 Fairfield Rd., Canton, MI 48188; (313) 981-1785; e-mail: <vayda@erim.org>

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Please send news for this column to: **Mike Gerardi**, secretary, 3372 Olive St., Huntington Park, CA 90255; (213) 587-2929 (h), (310) 553-5050 (w)

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Marissa Martinez and her partner, Kathleen Benson, welcomed Carlos Thomas Benson Martinez into the world in December. Marissa is a program manager at Microsoft Corp., where she designs and project manages software products in the Science and Engineering Tools group. This year and last, she returned to MIT to co-teach an IAP course on software design and development. She is also co-editing a book with Jocelyn White (Wellesley '83) on lesbian health to be published next year by Seal Press—thus proving that majors in XXI-E can utilize both aspects of their degree.

Michael Collins models the propagation of gravity and acoustic waves from comet impact sites. He had a great trip to England in December, staying in Cambridge for a few days and then attending an acoustics conference in Weymouth. He received the A.B. Wood Medal from the Institute of Acoustics. . . . **Alan Oppenheimer** and his wife finally moved from Silicon Valley to Ashland, Ore., after years of thinking about it. He leaves Apple Computer after 11 years to start his own company, Open Door Networks, Inc. Open Door's principal goal will be to provide easy-to-use Internet access for Macintosh computers. Anyone interested in more details on the company or on Alan, Priscilla, and Kingsford the cat should try <http://www.opendoor.com>.

Jeff Lukas and his wife, Lauren, welcomed their second son, Stephen Clark, on October 7. Their sons could be third generation techies, since Lauren's father is Nick Blazensky, '54. Jeff is now director of pediatrics at Tri-River Family Health Center in Uxbridge, Mass. . . . **Mark McQuain** and his wife, Dee, have been busy with their three boys, Byron (7), Will (6), and Taylor (4). Mark practices medicine in the Tennessee mountains, and breathes a sigh of relief that the Clintons did not have their way. . . . **Howard Haber** practices cardiology at Pennsylvania Hospital in Philadelphia.

Pat Kinny has worked at John Hancock since graduation. He writes that he lives an uneventful life (not surprising for someone who could stay at John Hancock more than 12 years). He attended the wedding of **John Hryniewicz** and Robin Rustad (Wellesley '8?) in May 1994, where he had the honor of being best man, having known John since junior high school days. Many MIT folks attended. . . . In June, **Robert Sah** married Valerie Tan, '94, in San Diego, where Bob is a professor at UCSD. There were far too many MITers to name, especially since the class years span a decade and a half. Pat just purchased a second home in Wellfleet on Cape Cod, where he looks forward to long weekend getaways. He'll rent it out during the summer season. As class president, Pat notes that we are now halfway between class reunions. Pat and I urge all classmates to start thinking about returning to Boston and MIT in June 1997 for our 15th reunion; it will be a lot of fun.—**Helen (Fray) Fanucci**, 502 Valley Forge Way, Campbell, CA 95008; e-mail: <fangroup@aol.com>

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We received notification from Franklin and Marshall College that **Calvin Stubbins** was recently awarded tenure as associate professor in physics and astronomy. Calvin went to Franklin and Marshall as an assistant professor in 1989 after graduating from Stanford with a PhD. He has done research on energy state calculations of Hamiltonian systems at

Franklin and Marshall, and spent a summer at Goddard Space Flight Center developing a statistical approach for determining the rigidities of cosmic rays in magnetic spectrometers. Calvin is also a member of the American Physical Society, The National Society of Black Physicists, and he is a referee for the journal *Physics Letter A*.

Ron Sticinski writes from Vienna, Va., where he is currently a naval engineering consultant to various government clients. Ron works for Booz, Allan, and Hamilton in Crystal City, Va. He is married to Naomi Keesee Sticinski and they have two children—Alex (4) and Nicholas (2). Ron was also recently promoted to commander in the Naval Reserve, supporting the naval weapons station in Earle, N.J. . . . **Peggy Kniffin** writes from Phoenix, where she is working for Motorola as a device section manager in one of the R&D laboratories. Peggy finished post-doctoral work at Stanford in 1991 and continues to play as much volleyball as she possibly can. . . . **Rachel (Cotter) Ramsay** writes that she has returned to the Boston area after nine years working for ROLM in Santa Clara, Calif., and then a couple of years in Sydney, Australia. Rachel is currently a full-time mother at home with her four- and two-year old children. . . . **Burunda Prince-Jones** writes that Cedric and she are expecting their second child in February 1995. Life has been exciting as son Kamalis (2) is developing "faster than the speed of light" and Cedric was recently promoted to group product director. . . . **Jose Rodriguez** writes that he has recently formed his own company called Advanced Packet Switching, Inc. The company will specialize in satellite communications and tactical imagery workstations.

Allison and **Brian Jacobs** recently announced the birth of their first child, Clayton. Brian is one of four classmates who chose venture capital over working for a living. Brian specializes in early stage technology investing for St. Paul Venture Capital. Other classmates in the industry are **Damien Wicker** at Chemical Venture Partners, **Frederick Wilson** at Euclid Partners, and yours truly.

Please keep those cards and letters coming.—**Jonathan M. Goldstein**, secretary, c/o TA Associates, High Street Tower, 125 High St., Suite 2500, Boston, MA 02110; fax: (617) 574-6728

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The big news here in California is the amazing rain we had in January. In one weekend, parts of Northern California near Mt. Shasta got a whopping 25 inches! If that had been snow, it would have amounted to about 20 feet. In the Bay Area, we received 200 percent of our annual average rainfall by the end of January. One night a street near my house flooded, and I practically floated my car the last 200 feet to the driveway of my new home. The waves were lapping at my driveway, as my vehicle with its newfound amphibious capabilities lumbered, smoking and sputtering, out of the sea onto shore in a quasi-reenactment of evolution. Amazingly it survived the ordeal intact, and a whole lot cleaner to boot.

John Hack writes, "I spent five years in Oakland, working at TOPS (part of Sun Microsystems) and playing a lot of bridge. Through bridge club, I met Mary Beth 'MB' Walsh (Haverford '84). MB and I were married in June 1991, after moving to New York City in the fall of 1989. She is working on her doctoral dissertation from Union Theological Seminary in New York. We moved to the Westchester 'burbs this spring just in time for the arrival of Sean Gabriel Walsh Hack, born July 8, 1994. Despite high expectations, I never imagined that being a father would be so great. I'm VP and manager of computer systems development at AIG Trading Group, a commodities trading firm. I will receive a master's degree in management of technology from Polytechnic University of New York this May. In my spare time, I work in the yard, growing vegetables and landscaping with perennials, building an organic oasis in the midst of chemicidal suburbia."

Gary Hallmark is married and has two sons. He lives in San Carlos, Calif., and works at Oracle designing parallel database systems. . . . A very interesting update comes from **Lincoln Greenhill**, who works at the Harvard-Smithsonian Center for Astrophysics in Cambridge. "I've discovered a black hole in the nearby Galaxy M106. This beats the Hubble Space Telescope's claims for now. And I discovered it with ground-based radiotelescopes. Watch where you step." . . . **Will Gaherty** has some accomplishments to announce: He co-owns a 25-person environmental consulting firm in Vancouver, B.C. He bought a house with his five-year significant other, Janice Johnson, and took a year off skiing. Last year Will joined the Educational Council. This year he visited the East Coast and saw **Andy Levy**, Karin Getschow, '85, Chris Getschow, '85, and Bob Thayer, '85, while in Boston.

Thanks to all of you who sent in updates. Keep 'em coming! I'd especially like to hear from anyone who has done some interesting travel lately (that means you, **WJK**.).—**Jonathan Miller**, secretary, 1708 Plaza Ct., Mountain View, CA, 94040; tel: (415) 961-2394, fax: (415) 813-1130; e-mail: <jonathan_miller@logitech.com>

85 10th Reunion

Extra news this month because I missed last month's deadline due to work-related travel.

Henry Steward "Stu" Cobb writes, "I put this list together from a variety of sources—and realized that I've lost track of a lot of my friends. Assuming the reverse is also true, here's the story of my recent life: Joined the Air Force to pay back ROTC. Worked four years in Houston as a Space Shuttle flight controller, from just before *Challenger* through the first three missions after. The Air Force decided that was too much fun for a lieutenant, so they sent me to LA as a project manager in the Space Test Program. Despite two years of official visits to France and unofficial visits to Hermosa Beach, I saved the Air Force more money on space tests than I'll ever make in my life (it says so right here on my evaluation :-). Along the way, I conned USC into handing me an MS in systems management. Not to be outdone, Stanford offered me a fellowship for a master's in aero/astro (as opposed to XVI), so I punted the Air Force in August '91 and moved half a megameter north.

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"I've been here ever since. Got the MS, now I'm halfway through a PhD. Stanford has a fairly large program looking at GPS satellite navigation applications in aerospace. As part of that, three other grad students and myself are building a GPS-based autoland system for airliners. It's a pretty good box [cheaper and more reliable than existing systems.] The FAA likes us a lot, and they've been funding flight tests for the last year or so. In July we had 49 successes in 49 approaches on an FAA King Air; in August the FAA administrator flew two landings with our system, and we flew the administrator of NASA as well. Our GPS-based Integrity Beacon Landing System com-



JEFFREY G. NANIS, '85
1962–1995

After graduating from MIT with a degree in aero & astro, Jeffrey Nanis worked as an operations analyst with the Johns Hopkins University Applied Physics Laboratory, and later at Lincoln Lab. As a military analyst, he worked with advanced radar systems. One of his projects was included on a space shuttle mission. Other areas he examined were threats to the U.S. Navy and the effects of nuclear explosions on the ozone layer. Please see obituary at the end of the Class of '85 column.



'85 MARRIES '86 . . . and invites half of MIT: Front row (l to r): Julian Bussgang, SM '51; Ruth Fricker, SM '85; the bride, Anne Fricker Hutchinson, '86, and groom, Jim Hutchinson, '85; Bill Messner, '85; Dave Sherman, '85; Karen Wohl Schmitt, '86; Ray Schmitt, '86. Second row: Kelsey Key Taussig, SM '87; Andy Renshaw, '85; Amy Austin Renshaw, '87; David Beymer, SM '89; Professor Tommy Poggio; Brian Subirana, PhD '94; Mark Emineth, '86; Jim Manzi, '84; Mary Cox Engebreth, '86; Ellen Epstein, '86; Ray Brunsburg, '86. Third row: Carl Taussig, PhD '87; Dean Ammer, '48; Clint Merrill, '72; Steve Smith, '84; Steve Fricker, ScD '53; Charles Stutt, ScD '51; Melvin Stone, '51; Tony Liepert, SM '82. Back row: Don Gray, '50; Erik Vaaler, ScD '91. Also attending but not shown: John Ruze, ScD '52; Marty Rauchwerk, '85; and AI Lab friend Xiru Zhang.

pleted 110 fully automatic landings on a United 737 in mid-October. That got fairly wide notice; I'm told we made it onto the CNN international feed. I was in the plane running the system (and crossing my fingers) for all 110 landings."

Roy Peterkofsky sends e-mail: "After five-plus years with USAir, it's time for me to move on. Starting with the new year [1995], I'll begin working in strategic planning for Matson Navigation, a shipping line headquartered in San Francisco. I prepared for the loss of my flight benefits by taking 13 trips in the last 8 months—I now feel that I've seen enough of the world to last me until I've built a stockpile of frequent flyer miles up from scratch!". . . **Lief Ulstrup** also sends e-mail: "My wife, Julia (Wellesley '85), and I had our second child, Sarah Bailey Ulstrup, on December 28, 1994. Mother and daughter are doing fine and our son, Christian, is adjusting to being a big brother. Had the opportunity to catch up with Dr. John Sapirstein, '86, Max Salinas, '84, and his wife, Lisa, Lieutenant. Peter Ulrich, '84, Jody Franklin (Wellesley '84), and husband David Gillete, and **Brook Sullivan** over the Thanksgiving holidays. Also, saw **Chris Furlong** and his wife, Cathy, in Washington, D.C., in November. I'm still working with American Management Systems (AMS) in Arlington, Va., leading a management/systems consulting practice concentrating on 'reengineering' large industrial organizations."

Gregory Fu is in the second year of his return to MIT as a faculty member, assistant professor in Course V, following a PhD at the little liberal arts school up the river, and a postdoc at Cal Tech. He was recently awarded one of the prestigious NSF National Young Investigator Awards. . . . **Eugene Fitzgerald** has also returned to MIT as a faculty member, just last fall as an assistant professor in Course III, following a PhD at Cornell, and an impressive stint at Bell Labs, where he was awarded a number of patents. . . . **Keith Eshleman** was recently promoted to associate professor in the Department of Environmental Sciences at the University of Virginia. His teaching and research interests are in the areas of watershed hydrology, wetlands hydrology, and water quality.

Jeff Gross gives us news from Vermont: "My wife, Elizabeth 'Biz' Williamson, '86, and I have been working working for IBM here in Essex Junction, Vt., since we got PhD's from MIT in 1992. I'm an analog IC designer while Biz is manager of the IE Department of one of the IC production lines here. Every September, we have been leading a group of friends from MIT on a hiking trip to climb Mt. Katahdin in Maine. Last year was the fifth year running that we have lead the trip, with a big turnout of MITers. Joining us were Kathy Krisch, '86, Rod Hinman, '88, and wife Shannon, Fritz Hermann, '87, Sharon Els, '88, and Jennifer Lloyd, '89, plus some of our friends from MIT graduate school: Ray, G'92, and Julie Bratvold Ghanbari, G'90, Steve Evangelides, G'91, Bruce Easom, G'92, Joe Lutsky, Chris Umminger, Steve Decker, and Mike Chuang. We ran into a driving rain/sleet/snow-storm at the top of the mountain, but everyone had fun. **Curtis Tsai,** '85, and Julie Tsai, G, go on the hike most years, but didn't this year because it conflicted with their honeymoon in Hawaii."

Margaret (Hirlinger) Douglass reports that she and Scott Douglass, '84, have been living in a medieval house in a small village outside Cambridge, England, since last summer. Sons Alan, 7, and Jeff, 5, attend the village school and have English accents. Anna will be three next month. Margaret got an MS in physics at Stanford sometime in the late '80s but has been too busy with the kids to do physics for seven years.

Finally, it is with deep regret that I inform you of the death of **Jeffrey Gabriel Nanis** on January 26, 1995, at the MIT Infirmary after an 11-year battle with cancer in the form of rhabdomyosarcoma. Jeff was 32. He is survived by his parents, Lucille (Kraft) and Robert Serody of Melbourne, Fla., and Marshall Nanis and Laurie Joslin of Lowell; his sister and his grandmother. Jeff was buried in a private ceremony on Martha's Vineyard. Remembrances may be made to the Dana Farber Cancer Institute, 44 Binney St., Boston, MA 02215.

Send news to: **Bill Messner,** secretary, 5927 Alder St., Pittsburgh, PA 15232; (412) 361-4180; e-mail: <bmessner@cmu.edu>, Class of 1985 listserv: <mit1985@mitvma.mit.edu>

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If you haven't heard already, as of this writing, it is now the middle of Boston's "non-winter" of 1995, and we're still enjoying relatively mild temperatures (in the 40s) with only one major snowstorm having hit us.

Michelle Sernaker writes from California that she's working on the Space Station for McDonnell Douglas, and is also trying to get through a master's thesis at the same time. She, like most of us, has hit the major life milestone of turning 30 and is now used to it, "but it's sort of disconcerting to go through the MIT Class Notes in *Tech Review* and have to dig back to find our year." . . . **Eddie Gornish** completed a PhD in computer science at the University of Illinois. He is now working for Hewlett-Packard in Cupertino, Calif.

John Rudnick writes from the Electrical Engineering Department at UCLA that he and his wife, Sarah, visited **Ray Covert,** his wife, Amea, and their newborn, Christopher, around Christmas. Ray has just completed an MSEE. John and Sarah also caught up with **Greg Harrison** and his delightful main squeeze, Dr. Nichole Mihara, at New Year's. Greg recently received another much deserved commendation medal from the USAF despite long ago leaving for NASA's Jet Propulsion Lab. John then had the pleasure of staying with **Ben Costello** and Ben's terrific partner, Cathy Chou, while in the SF Bay area to present some work in game theory to the American Mathematical Society annual meeting. Ben is running his own startup near Berkeley, manufacturing microsensors.

Steven Leduc is president and CEO of Hyperlearning, Inc., an educational services company headquartered in San Diego with centers throughout California. He wrote a differential equations text for Cliffs Notes, to be published in 1995, and is now writing a linear algebra text. He teaches math and physics for MCAT preparation through Hyperlearning. . . . **Alan Sayre** writes from the Netherlands that he's currently employed with the International Flame Research Foundation (IFRF) in the Netherlands working in the area of combustion research on burner design. . . . **Susan Havelka** and her husband, Walter Dackiw, '85, along with 2.5-year-old son, Jean-Nicholas, are relocating to Berlin, Germany. Walter is working for Tishman Speyer Prop-

erties in Berlin on a major real estate development for Sony in Potsdamer Platz.

That's all for now. Keep those letters coming.—**Bill Hobbib**, secretary, 5 Cappy Cir., West Newton, MA 02165; e-mail: <billhobbib@aol.com >

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Contributions to this column via e-mail arrive regularly, and for that I thank you. We only have electronic addresses for about 20 percent of our class, though, and while that is good, it would be great to improve that number. If you know of a classmate who is not on our mailing list (or even if you are not sure) please send the information to me <leifer@scarolina.edu>. I promise that no one will be inundated with junk e-mails from my side.

Julie Marquet is halfway through her internship in family medicine at the University of Washington. In all of her copious (ha!) free time, she's picked up mountain-biking and kayaking. . . . **Landon Pate** accepted a position with Marion Merrell Dow Pharmaceuticals in Kansas City after completing an MBA at the University of Michigan. He is currently a financial analyst and information systems advisor acting as a liaison for North American area fiscal systems, and also fulfills roles as data coordinator and client analyst. In his free time, Landon enjoys roller skating, a carryover from his undergraduate days. He's currently looking for a suitable motorcycle with which he plans to tour the midwest when he finds time to sneak away from the office. . . . **Gregory Mount** graduated valedictorian from the University of Chicago Graduate School of Business in June 1992. He is currently an associate at Morgan Stanley and Co. in New York City, in the area of investment banking.

Kaveri Suryanarayan and **Mark Mastandrea** joyfully announce the birth of their daughter, Viveka Nicole, on January 15, 1995. "Niki" measured in at 6 pounds, 14 ounces, and was 19 inches long. Mother, baby, and father are all doing well. This past July, Kaveri and Mark moved to Mountain View, Calif., where Mark now works as an operations management consultant for Pittiglio Rabin Todd & McGrath. (Another recent e-mail indicates that **Kelvin Phoon** is also working as a manager at that firm.) Kaveri recently finished a residency in pediatrics at the Boston Children's Hospital, and will begin a fellowship in pediatric hematology and oncology at the Lucille Packard Children's Hospital at Stanford University.

A couple of brief job changes: **Mark Foringer** is now at the Propulsion Directorate of Wright Labs. He's working on the design of advanced materials for jet engines. . . . **Jim Bernabeo** has moved back home to Long Island, N.Y., from Connecticut, where he works for Loral Fairchild Systems. Jim finds the work, which deals with the design of airborne cameras, to be an interesting change from what he was doing previously.

Tom Hoffman knows how to use free time wisely—he wrote me a long note about the goings-on of himself and some of his DU cohorts while on a 20-hour flight to the Far East. Upon graduating from Harvard Business School in 1992, Tom joined a global manufacturing group at the Colgate Palmolive Co. Working out of their New York City office, Tom's group does internal consulting and project management for the 75-plus C-P manufacturing facilities world-wide. Over the past two and a half years he has done work for the company in Bangkok, Kuala Lumpur, Manila, and Mexico City. Traveling has given Tom the opportunity to mix business with pleasure, and he has met up with Pledge Brothers **Corey Kerstetter** and **Geoff Kolsch** on excursions to Italy and Austria, as well as England and France. Corey is currently finishing an MBA at Wharton Business School, while Geoff is working for MIL-3 in Washington, D.C. A host of other DU alumni, including **Mike Roberts** and **Eric Andrews**, also work in Washington, and the D.C. DU's do try to get together for an occasional (OK, frequent) brew.

While visiting Geoff (who was previously working in LA) for Thanksgiving 1992, Tom met his new wife, Christine Rakiey, who was Geoff's next door neighbor at the time. They



BETSY'S WEDDING
From left: Molly Kihara, '87, Linda Chao, '87, Rose Joseph, '86, Betsy Parker, '87, Mavis Lee, '88, Linda Marinelli, '87, and Connie Moy, '87.

ClassNotes

managed a long distance relationship for a year and a half, and were finally married on September 17, 1994, in Los Angeles. The ceremony was at Mount St. Mary's College in Pacific Palisades, and the reception was held at the Santa Monica Beach Club. The majority of the '87 DU pledge class (Corey Kerstetter, Geoff Kolsch, Mike Roberts, Eric Andrews, **Tim Jones**, **Todd Malone**, **Greg Mount**, and **Tom Zirps**) traveled from all over the world to be at the wedding, as did a number of DUs from the class of '86. Tom and Christine spent 11 days in Maui, and are now settled in New York City.

Jerry Hershkowitz is glad to be back in Boston, having left his job with Motorola in Austin, Tex., to take a job with Analog Devices. Besides enjoying all Boston has to offer, Jerry's latest endeavor is working as an English as a Second Language tutor, through a program sponsored by the Boston Public Library. Since the tutors meet with the students once a week at the Library, it is the perfect opportunity to get to downtown Boston/Cambridge from the suburbs on a regular basis.

Betsy Parker was married this past summer in Attleboro, Mass. She and her husband, Jerry Smieszny, met when they were both working for Kraft Foods back in 1987. After several job changes for both, Betsy is in her third year of teaching science at New Trier High School in Winnetka, Ill., while Jerry is now working for Abbott Labs in North Chicago. While the two are currently renting in Evanston, they hope to purchase a home in the near future. Several of Betsy's good friends from McCormick Hall attended the wedding. Rose Joseph, '86, was a bridesmaid, and former roommates **Linda Marinilli** and **Molly Kihara** (all the way from LA) attended. Other Fifth Westers included **Linda Chao** and Mavis Lee, '88, as well as honorary FWFW **Connie Moy**. The next morning, the car carrying the Lindas, Molly, and Mavis coincidentally passed by the Boston Harbor Hotel, where Jerry and Betsy were waiting for their own car to be brought around, which was an unexpected surprise.

The Alumni/ae Association office has received word that classmate **Cathy Comeau** passed away on December 6, 1994. She was living in Chelsea, Mass., at the time of her death. We extend our sympathy to Cathy's family and friends.

Until next month...—**Jack Leifer**, secretary, 2908 Roses Run, Aiken, SC 29803; home: (803) 642-3900, work: (803) 648-6851, fax: (803) 642-2700; e-mail: <leifer@scarolina.edu>, Class of 1987 listserv: <MIT1987@mitvma.mit.edu>

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If you have an American Heritage College Edition Dictionary, look up "discus" and you will be in for a pleasant surprise. You will find a picture of an MIT athlete throwing a discus on the outdoor track in front of Baker House. Can you figure out who that

athlete is? If you have not been in this column recently please write in and let your classmates know where you are living and working, regardless of whether or not you can throw a discus.

Dave, '87, and **Joycelyn (Valderrama) Koehler** are now a party of three. Kristen Alicia Koehler was born on February 10. Kristen is happy and healthy and enjoys keeping her parents busy. . . . **Tupper Hyde** is working on a PhD at MIT, with about a year to go. He has a new job in the Army reserves, instructing electronic warfare. His wife, Laura (Wellesley '88), has been teaching 11th grade U.S. history at Nashua High School since August. Their son, J.T., is now a very active 3-year-old.

Bob and **Sheila (Neville) Flory** had dinner with **Brenan McCarragher** during his recent trip to the United States. Since graduation Brenan received a PhD in mechanical engineering at MIT, married Hilary in Ireland, and accepted a teaching position at the University of Australia in Canberra. Brenan now has two children, Cera (18 months) and Caleb (4 months). The whole family is traveling with Brenan on a working vacation to the States and then to Belfast.—**Catherine Suriano Singer**, secretary, 131 Main St., Andover, MA 01810; e-mail: <singer@mit.edu>

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Greetings! Thanks to everyone for writing this month, and please keep those pens rolling and keyboards clicking!

This month's list of people to please send news: **Adam Dershowitz, Niraj Dube, James Goldstein, Karen Kowama, Michael Monegan, Scott Ritterbush**, and **Jessamy Tang**. What are y'all up to? If anyone knows about any of these people or anyone else, please write in.

Eileen Koefoot writes that she and her husband, Eric, '87, have been blessed by the birth of a son, Daniel George, on December 6, 1994. Eileen writes, "Our little boy isn't so little—he's been packing on the pounds—up to 13 pounds so far." Eileen is currently on leave from Ford Motor Co., where she has worked in powertrain engineering for the last five years. . . . **Andrew Long** writes from Australia, where he has been receiving and reading *Technology Review* (voted more credible than the *Harvard Business Review*!). Andrew has been "down under" since graduating and is working for Optus, the second telecommunications carrier after deregulation.

Gene Lee writes from the Department of Computer Science at the University of British Columbia to inquire about the e-mail list and the Web site (as did Andrew). . . . **Nick Newman** has just got connected to the Internet via the Kirksville College of Osteopathic Medicine in rural Missouri (in Kirksville!).

On February 4th, by unanimous vote, it was decided that **Angeli (Salgado) Maney** would list all the alums who were able to make it to **Bill Maney**'s 28th birthday party. Not in any order, they were: Bill and Angeli, **Dean Chang**, Dave Berners, '90, Sally Araki, '92, **Andy Barrows**, Grace Tsen, '90, Mike Caren, '91, **Annabel Nickles, Dan Garcia**, Dave Maes, '88, **Illy King**, Greg Carlin, SM '89, **Ron Koo, Phil Kuhn, John Flight, Joe** and **Elizabeth (Greyber) Lichy**. Angeli writes, "It was a fun party and it was great seeing everyone. We had quite a few guests from Maxim Integrated Products, where Bill has been working for five and a half years. **Rodrigo Madanes** was supposed to come, but he was in the middle of packing up to go to Guatemala, where he plans to get some studying done for his June orals. Bill was saying that other people go to the library to study, but Rodrigo goes to Guatemala."

Angeli and Bill have enjoying their new house. Angeli writes that it is "great for parties. :-) We've been here for almost a year and have had quite a few people stop by: Laura Scolnick, '90, was here June 1994 for a short visit. **Mark Moss** was here in September 1994 and we are again expecting him in February for a few days." Mark is about to start classes at Fort Gordon, Ga., for a few months, after spending a few years in Okinawa, Japan, with the Army. Mark is engaged to Sylvia, a DOD teacher, who he met in Japan. They're getting married on August 12, 1995, in Abernathy, Tex. "Other house guests include Joe Landry, '88, who is finishing up a PhD at the University of Michigan. We also had **Mark Coiley** and **Steve Payne** stay with us in July 1994 when Dan Mittleman, '88, got married in Berkeley to Vicki Colvin (Berkeley PhD '94)."

Angeli continues, "I'm busy with my business and am in the middle of tax season right now. Both pension and accounting's busiest time is now, so it gets a little crazy. Bill's a really good influence on me, since he likes to 'drag' me away from work to go snowboarding. We got snowboards for each other this past Christmas, and we're determined to get a lot of use out of them. We've tried them out in Lake Tahoe where the snow has been great! We also went to Breckenridge, Colo., with Dan and Vicki Mittleman, Steve Payne, Mark Coiley, Phil Kuhn and his girlfriend, Jenny, in January. Not as much powder as we had hoped for, but we still had fun."

"Bill and I are hoping to visit Asia this year, late November through December. My mom is in Bangkok, working for the United Nations, so that's one of the places we're planning to visit. I still have family in Manila, Philippines, and it would be great to spend Christmas there. We may also visit Nadine Regner, '92, in Hiroshima. "

Well, that's it again for this month. Please send in news! Photos for next year's calendar would be great as well (GIF or any electronic file format for photos are acceptable). Remember to check out the first World Wide Web URL to be published in *Tech Review*! <http://www.tns.lcs.mit.edu/mit89/>.—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142; tel: (617) 225-6680, fax: (617) 253-2673; e-mail: <hhh@mit.edu> or <henry_houh@mit.edu>

90 5th Reunion

John M. Wilson III and **Vandita Malviya Wilson** were married on July 31, 1993. In April 1994, they bought their first home, in the Bay area. Now John and Vandita work in Foster City, Calif., at the Western Regional Office of SAP America. SAP is a German-based client-server software application company. John and Vandita have traveled extensively in the past few years. They spent their honeymoon in Germany and Alaska and their first-year anniversary in Cancun. Now they are on a mission to visit all 50 states; they have visited 45 so far!

Andrew Knoedler writes that he and his wife, Audra, have completed their move from Wright-Patterson AFB, Ohio, to Edwards AFB, Calif. Now Andrew has officially started his training as a flight test engineer in the Air Force's Test Pilot School. (That's why he wanted to go to the Mojave Desert.) Former graduates of the program have told Andrew that the Test Pilot School is almost like taking Unified all over again. However, after a year of this training, Andrew will be fully qualified to test the world's best airplanes. . . . When the Knoedlers traveled to the West Coast, they visited **Fred Kennedy** and his wife, Vickie, '91, in their pink stucco "mansion" in the hills above Albuquerque, N. Mex. Perhaps their house is not a mansion, but it is in a gated community with its own golf course. . . . Andrew and Audra also visited **Alissa Fitzgerald** in Mesa, Ariz. Alissa's job at Orbital Sciences has allowed her to almost single-handedly modify an L-1011 aircraft so that it can launch rockets from its belly.

Irene Kuo writes that in May 1994 she finished medical school at the University of California/San Francisco. Now she works in ophthalmology at the Doheny Eye Institute of the University of Southern California Medical Center. Irene enjoys southern California; in May 1994, she ran the 12K Bay-to-Breakers race in San Francisco in her personal record time of 57 minutes. The Bay to Breakers race is the largest in the world—over 100,000 participate in it.

Hope to see everyone at our 5th Reunion! And don't forget, write to let your classmates know what you've been up to.—**Ning Peng**, secretary, 732 Bounty Dr., #3215, Foster City, CA 94404; (415) 578-0704

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Albert Lew has been a software engineer for Teradyne in Agoura Hills, Calif., for three years. Other MIT alumni/ae at Teradyne with Albert include Paul Roush, '82, Dave Kwon, '89, Melissa Kwok, '93, Weip Chen, '94, Kevin Knoedler, '94, and Daiji Takamori, '94. Albert and his wife, Anita Colasante (UMass/Amherst '87), recently celebrated their first wedding anniversary with a three-week trip to Europe. The trip began in Trollhattan, Sweden, where they bought a new SAAB 900 Turbo. Other highlights included the delectable Italian pastries and gelato, and the Oktoberfest in Munich. A favorite adventure took the couple via tram up a mountain to explore ice caves near Halstaat, Austria. Albert would love to hear from people via e-mail at: <albertl@std.teradyne.com>.

Garth Zeglin worked in Boston for two years, first for Bolton Engineering, a small engineering consulting firm, and then for Boston Dynamics, a startup founded by Marc Raibert, his undergraduate thesis advisor. Now Garth is in the second year of the PhD program in robotics at the Carnegie Mellon University Robotics Institute in Pittsburgh. He enjoys the support CMU provides for its graduate students. Other classmates in this program are **Peter Berkelman**, who had been in Japan and is now in his first year, and **Wes Huang**, now in his fourth year. Garth is also

The Good Books of MIT

By Toby Sanders '90

I recently returned from a month of traveling in which I spent a lot of time catching up with friends from MIT. While spending the night in dens and spare bedrooms of newly purchased homes, I detected a strange trend. Bibles. I am not speaking here of the religious kind but rather the MIT version: a binder of lecture notes, problem sets, papers, and exams from a particular course, with the course number boldly printed on the spine of the collection.

Once I became aware of the trend, I started making a point of mentioning these volumes in conversation. From these informal discussions, I have come to the conclusion that a typical MIT grad owns somewhere between five and ten such bibles. Although former graduate students claim they still refer to theirs, rarely did undergraduates say they keep a bible around because they actively use it. Surprisingly, the excuses became familiar. I was told over and over how the bibles were not related to a current job, but their owner was not yet willing to get rid of them. "In another year or two" seemed a rallying cry.

I cannot say that I am surprised by the whole bible phenomena. My father, Robert Sanders, is class of '64, and when I was in high school, I found a box filled with his old bibles when I was cleaning out our family basement. The box had not been opened for at least 15 years, so I moved it to the pile intended for the garbage. As soon as my father heard of my plans, he insisted that the binders be saved. Seeing that I had touched a nerve, I returned the box of punch cards and other relics drenched in nostalgia to some archival corner.



Not all alums save bibles; some leave them as a legacy to a living group or a friend, while others lack the compulsion to collate the materials into a volume in the first place. At the other end of the spectrum is the pack rat who indiscriminately keeps everything.

Why is it that we cannot throw away these reminders whose content is out of date and irrelevant to our careers? Maybe it is the coherence of the physical object itself. A bible by definition has an organization that makes it easy to store and that makes a collection of papers easily identifiable.

However, my instinct, corroborated by my small survey, suggest there is more to it than convenience. Sometimes a bible is valuable because the professor was a mentor or role model. Other times a bible is cherished for a particular teaching style the class exemplified, or maybe it contains a set of lecture notes not printed in any text. Bibles conjure up the friendships that emerged during the all-nighters, or the sheer challenge of a clever problem set. In most cases, however, bibles simply represent a ton of work. I claim that the bibles that still linger on our shelves and in our closets, attics, and basements represent personal history and achievement as well as respect for our MIT educations.

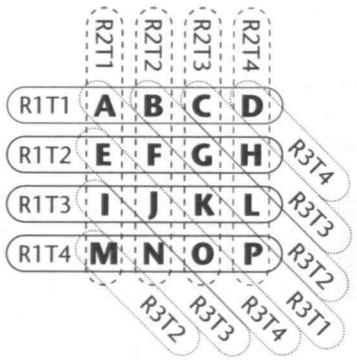
I have my own collection of bibles cluttering my shelves—eight, in fact, only one or two of which I have consulted since graduation. My collection represents many friendships, opportunities unique to MIT, and unequaled teaching styles. I do not doubt that in another 15 years, a new generation of children will be wondering if "not yet" really means "never" and be laughing about my own odd collection of memorabilia.□

ILLUSTRATION: JON McINTOSH

Puzzle

Continued from Page MIT 55

Jan 2. Jerome Dausman, a former U.S. Monopoly champion, was asked by Parker Brothers to judge a regional championship, which consists of three rounds of play each with four tables. When there are 16 contestants the following pairings are used.



(The oval R3T2 contains the players who are to sit at table 2 during round 3.) This solution has no player playing the same opponent more than once. There were 14 contestants at the championship Dausman was to judge, so the decision was made to have two three-player tables and two four-player tables in each of the three rounds. An added requirement was that each player would sit at at least one three-player table and at at least one four-player table during the three rounds. Find a set of pairings so that the number of players to meet an opponent more than once (a "second pairing") is minimized?

This one is not so easy. Len Schaider's solution, printed below, has only two second pairings (meaning that four players are involved in second pairings). I received solutions with no second pairings, but they had either a player sitting at only three-player tables or a player sitting at only four-player tables, contrarary to the requirements of the problem given above. Schaider writes:

Given the rules of two three-player tables and two four-player tables, two contestants have to sit out each round. After selecting six "generic" groups (1–6) to sit in round one, some of the choices for rounds two and three become fixed. In the diagrams below, T3x is one of the two three-player tables and T4x is one of the two four-player tables; OUT indicates the two players sitting out that round.

For example, given the seating in R1, then groups 1 and 2 must sit at T4x during R2 or R3 and groups 3 and 4 must sit at T3x during R2 or R3. (See case A1). In R3, players 1 and 2 may sit at different T4x tables but that does not affect the answer.

Now, players 5 and 6 must sit at T3x in one round and at T4x in the other round. There are many choices for players 5 and 6, except that they cannot sit together at the same T3x table in either round because that would constrain one of the 3/4 players. So, there are two basic ways the 5/6 players can sit as shown in cases A2-A3. In case A2, players 5/6 sit at the T3x table in different rounds and in case A3, they sit at the T3x table in the same round. In both cases A2 and A3, there are many ways that players 1256 can sit at the four-player tables but these will not affect the answer.

	CASE A1			CASE A2		CASE A3	
	R1	R2	R3	R2	R3	R2	R3
T3A:	111	34-	34-	345	346	345	34-
T3B:	222	34-	34-	34-	34-	346	34-
T4A:	3333	12--	12--	126-	125	12--	1256
T4B:	4444	12--	----	12--	----	12--	----
OUT:	56	--	--	--	--	--	--

With this as a basis, the seating in R2 and most of the seating in R3 can be completed without having any "second pairings" as shown in the case Bx diagrams below:

		CASE B2		CASE B3	
	R1	R2	R3	R2	R3
T3A:	111	345	346	345	34-
T3B:	222	342	34-	346	34-
T4A:	3333	1263	125-	1234	1256
T4B:	4444	1234	1234	1234	1234
OUT:	56	14	--	12	--

In both Bx cases, the 1/2 and 3/4 players that sat with each other in R2 switch places to avoid "second pairings" in R3. However, the remaining two seats cannot be filled without the "second pairing" problem. For example, in case B3 above, the open seats at the T3 tables can only be filled by 1/2 or 3/4 player. If a 1/2 person is seated, it would be a person that sat with the 3/4 person at one of the T4x tables in R2. (The 1/2 players that sat out R2 have to sit at a T4x table in R3). If a 3/4 person sits in an open seat, it would be a person that sat with the 3/4 person at the T4x tables in R1. Any variations of the 1256 people between the T4x tables does not avoid the "second pairing" problem, so the only solution will have two sets of "second pairings" in R3, as shown with 16 unique players in case C:

CASE C

	R1	R2	R3	
T3A:	ABC	GKO	IMH	<== second pairing, H and I
T3B:	DEF	HLP	JNK	<== " " , K and N
T4A:	GHIJ	ADIN	CFOP	
T4B:	KLMN	BEJM	AEGL	
OUT:	OP	CF	BD	

Better Late Than Never

1994 A/S 1. Robert Norton remarked that the published solution is correct (rarely are such remarks sent; this time the solution confirmed his personal "trip to becoming a Life Master in the ACBL"). However Jorgen Harmse sees it a little differently. You can write to the editors for a copy of Harmse's analysis.

1995 JAN SD. Several readers noted that circles are not the only figures with property given (e.g., equilateral triangles also cannot pass through a similar cutout). Another big advantage for round manhole covers is that they are easy to roll.

Other Responders

Responses have also been received from B. Bruno, S. Chilton R. Fieldhack, M. Fountain, T. Giuffrida, C. Goodwin, J. Harmse, W. Hartford, R. Hess, M. Lindenberg, R. Norton, K. Rosato, A. Rosen, and I. Shalom.

Proposer's Solution to Speed Problem

It will run forever, 1/i quickly gets so small that its addition to sum has NO effect.

becoming serious about music. He has resumed trumpet lessons, and recently formed a brass quartet.

Courtney Moriarta works for the Conservation Services Group in Boston, which helps Boston Edison's residential space heat customers to save energy. Courtney moved to Weston, Mass., in January with her fiancé, Kent Lundberg, '92, and Hazel, their pet rabbit. They will marry in May. . . . As for myself, I also recently spent some time in Weston (my home town) for the Weston High School alumni/ae swim meet, at which Dinesh Lathi, '92, Vijay Lathi, '94, and I re-enacted three-fourths of our speedy 1987 medley relay (only a bit slower this time). Dinesh is attending Harvard Business School and Vijay is working toward a master's degree.

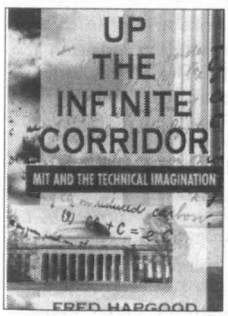
Chantell (Wyland) Kuhlmann is at the Los Angeles Air Force Base with **Renee (Mong) Miller**, who continues to provide so much

Technology Review Books Salutes MIT Authors

Up the Infinite Corridor
MIT and the Technical Imagination

by Fred Hapgood

This lively, eminently readable account of MIT's engineering research will stir up memories while bringing readers inside some of the current projects happening around the Infinite Corridor. Delving into MIT's rich, sometimes bizarre history, *Up the Infinite Corridor explores* the folkways of undergraduate life, as well as the unique sense of humor that emerges from the pressures and insecurities of the place where everyone's intellectual accelerator is wired to the floor.



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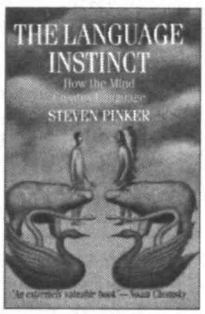
NYT bestseller

The Language Instinct

by Steven Pinker *Professor and Director of the Center for Cognitive Neuroscience at MIT*

Steven Pinker lucidly explains everything you always wanted to know about language: how it works, how children learn it, how it changes, how the brain computes it, how it evolved.

With wit, erudition, and deft use of everyday examples of humor and wordplay, Pinker weaves our vast knowledge of language into a compelling theory: that language is a human instinct, wired into our brains by evolution like web spinning in spiders or sonar in bats.



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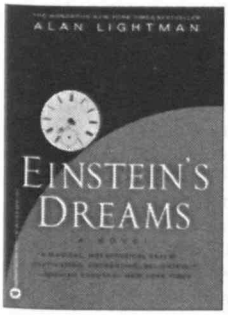
NYT bestseller

Einstein's Dreams

by Alan Lightman
Professor of Science and Writing at MIT

A novel.
In one world time is circular, its people fated to repeat triumph and trial over and over again . . . in another, men and women try to capture time—which appears as a nightingale—in a bell jar...in another, there is no time, only frozen moments. All are visions that gently probe the essence of time, the adventure of creativity, the glory of possibility, and the beauty of Einstein's Dreams.

"A wonderfully odd, clever, mystical book of meditations on time, poetically spare and delightfully fresh." Chicago Tribune



Paperback, 179 pages, $7.99

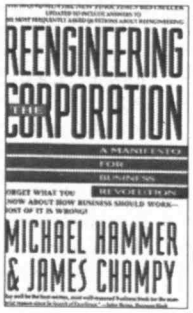
NYT bestseller

Reengineering the Corporation

by Michael Hammer, '68 and James Champy, '63

Reengineering the Corporation, the international bestseller, is the pioneering book on the most important topic in business circles today: reengineering – the radical redesign of a company's processes, organization, and culture to achieve a quantum leap in performance. Michael Hammer and James Champy show how some of the world's premier corporations are reengineering to save hundreds of millions of dollars a year, achieve unprecedented levels of customer satisfaction, and speed up and make more flexible all aspects of their operations.

"This book is an outstanding and important piece of work and easily readable. The payoff is dramatic improvement in cost, quality, and customer satisfaction" Robert E. Allen, CEO, AT&T



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news to these notes via e-mail. Chantell works in the Space Based Early Warning System Program office, which is currently undergoing "re-engineering." Chantell is responsible for coordinating system performance models of the two operational systems in the program office. Renee says Chantell's daughter, Alexis, is "adorably cute." Chantell has worked with several alumni/ae, including **Scott Williams** and Andy Nisbet, '90, who used to work in her office, and Dave MacKay, '85, and Jon Strizzi, '92, SM '94, who now both work in her office. She went to an engagement dinner for Gay Martin, '90. Also she saw **Wisdom Coleman** when he visited from San Diego Naval Station. Wisdom flies helicopters off a carrier stationed in Japan. Last year as he finished his primary aircraft training in Corpus Christi, Wisdom ran into **Sunhi Yum** who was beginning primary training. The Navy sends news that Sunhi finished his training in Corpus Christi, Tex., and was designated a naval aviator and honored with the "Wings of Gold." Some of Sunhi's training included extended navigation flights and landings and takeoffs aboard an aircraft carrier.

James Scanlan married Soyoung Kim on August 22, 1994. They met 10 months earlier at an Itzahk Perlman concert at Symphony Hall in Boston. Writes James, "We were sitting next to each other listening to a 1950's piece by a Japanese composer that included a two-minute snippet of 'La Bamba.' We were giggling, but none of the baby-boomers in the audience seem to notice the humor." The wedding was attended by many TEPs and other MIT graduates: **Peter Kner, Joe Gomes, Nate Getrich, Andy Howe, Ian Dowell,** Tobe Barksdale, '85 (best man), Sean Garrett, '88, Ric Carreras, '85, Tom Froeschle, SM '66 (V), John DeRoo, '88, Michael Rhines, '84, Khota Ueno, '92, Joe Chapman, '79, Joe DeSantis, Catherine Rocchio, '89, as well as Rob Calhoun, '90, and Brian Lantz, '92, both of whom were also married during the summer. Soyoung's relatives came over from Korea, and James's nervousness about meeting her father subsided upon learning that Soyoung's father is also a mechanical engineer—and a professor and dean of engineering at Yansei University in Seoul. "In fact," writes James, "at the reception we had one table at which 8 of 10 people were named Dr. Kim and 6 of 10 were Mech Es, too!" James works for Bose Corp. in Framingham, Mass., and lives in nearby Marlboro.

Belinda Schmolke is working at IBM in South Africa training people how to use AIX, the IBM version of UNIX. She still enjoys the many business trips around South Africa and traveled to Ghana in October—where she was met at the airport by a chauffeur and body guard. Belinda notes that although life in the new South Africa has not changed dramatically for most people, there is a refreshing tone of optimism and hope for the changes Nelson Mandela may bring. . . . **Donna Khodarahmi** lives in Philadelphia but was in Boston for a medical school rotation in clinical genetics at the Children's Hospital. While in Boston, she visited with **Marianne (Augot)** and **Robert Fleischman**. Marianne is in her fourth year of Boston University Medical School and Robert works for BBN in Cambridge. Donna also spent time with her fiancé and his class of '93 pals. She hopes to be back in the Boston area next June to start a pediatrics residency and writes, "Keep your fingers crossed for me!" . . . **Thomas Shea** manages the currency derivatives portfolio for Bank Brussels Lambert in New York.

Please send your favorite news to: **Andrew Strehle,** secretary, 59 Commonwealth Ave., Apt. 4R, Boston, MA 02116; (617) 450-0637; or by e-mail to **Renee (Mong) Miller,** <miller-rl@post7.laafb.af.mil>.

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Congratulations to **Alexandra Witze.** This past December she was named associate editor of *Earth* magazine. Previous positions Alexandra held includes science writer for *The Dallas Morning News*, general assignment reporter for *The Salinas Californian*, and editorial intern for *Sky & Telescope* magazine. **Kevin Moore** writes that he is working for Ford in Detroit. He's been in touch with **John Ward, Erik Larson, Isy Goldwasser,** and Greg Lambrecht, '90. Kevin says that Greg is surviving marriage, and the in-line racing frames Kevin got him are being put to good use.

Soni Chung is teaching high school in Manhattan. . . . **Anthony Green** is a third year dental student at Columbia University School of Dental Surgery. He was recently elected national president of the Student National Dental Association. Anthony says Andrea Raymond, '91, is working for Lederle in Nyack, N.Y., and Charon Gwynn, '91, is pursuing a PhD at NYU. More news from the armed forces:

Kurt M. Steltenpohl returned from a four-month deployment to the Persian Gulf and Red Sea with the attack submarine USS *Miami*. Kurt was one of 133 sailors participating in a variety of submarine-surface ship exercises. A number of the crew members also volunteered to do community work while in Abu Dhabi, painting schools and delivering clothing and school supplies from the Project Handclasp effort. . . . **Melissa D. Kuo** was recently promoted to the rank of 1st lieutenant. . . . **Christopher M. Rein** was recently designated a Naval flight officer while serving with the Naval Air Training Unit at Mather Air Force Base in Sacramento.

I want to extend a thank you from our entire class to those of you who have actively contributed to MIT and the Class of '92 with your time, commitment, and funds. This year's Century Fund givers include: **Freeland K. Abbott III, Leslie A. Barnett, Jennifer Chan, Chonda Foster, Monte Frazier, Charles Goetz III, Juan Guerrero, Aileen Lee, Robert B. Pember, Adam Powell, Peter Ronco, Scott Seo, Emmanuel Voumvourakis, John Wong, Wataru Yamaguchi,** and **Shih-Jih Yao**. Century Fund givers are those who contributed at least $100 and up to $499.

Thanks also to those of you who participated in the '93–'94 telethon: **Cindy Evanko, Steven Peterson, Ganesh Ramaswamy, Rahul Dighe, Jonathan Fox, Ammar Kanaan, Peter Noymer, John Thomas,** and anyone I may have missed.

I am currently working on an effort to update our class list and would appreciate everyone's assistance. If you have recently moved, please contact me or the Alumni/ae Records office with your new address. This way, we can keep you updated on any class news and events. I will be personally contacting some of you out there for assistance, but if you would like to volunteer your help, write to me or call. Keep in touch!—**Leslie A. Barnett,** secretary, 88 Indian Hill Rd., Bedford, NY 10506; (914) 234-3943

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Please send news for this column to **Mari Madsen,** secretary, 12-16 Ellery St., #405, Cambridge, MA 02138; e-mail: <vayda@erim.org>.

94

Greetings! Noting the peculiar lack of '94 news in the February/March issue of *Technology Review*, I threw caution to the wind and volunteered as the class secretary. As such, let me open by begging for news. Send me the latest on what's up with you and your classmates; I need an excuse to avoid working on my master's thesis.

Filled with the hopes of sunshine in January, I made a plant trip to northern California and visited **Mark Uhrmacher.** Despite the rainy conditions, Mark took time out from his work in Oracle's video server group to show off his new Acura and to update me on the latest sushi bar hangouts. Mark shares an apartment in Palo Alto with **Yuval Koren,** who works in the SuperComputer Systems Division at SGI. . . . While in the Valley, I also heard from **Mike Kobb**. Mike has completed work on the Macintosh Programmer's Toolbox Assistant, and just joined the Macintosh Finder Team, where he will develop collaboration features in the System 8 Finder. Mike shares a house with, among others, Chris Cotton, '93.

Katy Oldham writes from Arizona that she "just started on my third rotation in my engineering rotation program at Motorola. I'm back in a wafer manufacturing area working in the photo group this time. It should be pretty interesting." Outside of work, Katy serves as a chapter advisor, designs landscaping for her new house, and is planning her upcoming wedding to Dave Towner, '92. . . . **Angela Choy** reports from Georgetown University Law School, "The classes are interesting and the people are nice." Angela adds that she misses her MIT friends, and she concludes, "I'm beginning to talk and act like a lawyer. We are being conditioned here!" . . . Meanwhile, from the heart of Texas, **Ed Sarnowski** writes that he is working towards a master's degree in engineering mechanics at the University of Texas/Austin. Ed notes that "being an RA and a TA at the same time leaves only a few days a month to enjoy the great mountain biking."

In putatively snowbound Massachusetts, **Sean Hogarty** reports that he has joined a company called NetMarket, based in Cambridge. "Things are pretty exciting here. I like the atmosphere: casual, yet challenging." Sean adds with considerable understatement, "Things are somewhat busy here.". . . Things been busy with you? Joined a company? Getting married? Already married? Completed another degree? Avoiding work on your thesis? Run into a few classmates? Send me a brief note.—**Jeff Van Dyke,** secretary, 23 Symphony Rd., Apt. 4, Boston, MA 02115; (617) 859-7760; e-mail: <jvandyke@mit.edu>

CourseNews

CIVIL AND ENVIRONMENTAL ENGINEERING

Craig M. Schwitter, SM '91, reports that he is a project manager for engineering with FTL/Happold, Inc., in New York City. Previously, he had worked in Atlanta on the construction of the cable roof on the Georgia Dome and in the United Kingdom on cable, glass, and fabric structures. . . . Also from the Big Apple, **Robert Newhouser**, SM '78, writes: "I am currently employed as deputy director of Transportation Planning Analysis for the New York City Transit Authority's Office of Management and Budget. I direct the authority's travel-demand forecasting activities, including forecasts for ongoing studies of future rail improvements in Manhattan's Second Avenue corridor and improved East River crossing service. I also direct the authority's first system-wide, on-board survey of bus passengers conducted in more than 10 years."

Eric F. Peyrard, SM '82, writes: "I left IBM in November 1994 and am now working for Oracle France as a sales manager. My team is in charge of the French government and ready to ride the information-highway wave. I even have an Internet address now: <epeyrard@fr.oracle.com>. I hope to hear from friends."

In September 1994, **Robert Skinner**, SM '71, became the executive director of the Transportation Research Board in Washington, D.C. He has been with the organization since 1983 and, during the past eight years, has managed its studies and information services division. . . . From Valatie, N.Y., **Robert W. Clark**, SM '63, writes: "Since September 1993, I have been an assistant professor of engineering at Adirondack Community College in Queensbury, N.Y. After 29 years of engineering, I received an MA in teaching from Union College in June 1992." . . . Currently serving as the president of both Ocean and Coastal Consultants, Inc., and Air Guard, Inc., **Stanley M. White**, SM '76, CE '76, writes: "We have developed pneumatic barriers used for oil spill control, CSO debris containment, water quality improvements, sedimentation control, and mitigating underwater blast propagation. Very exciting times for us!"

Bettina Margrit Voelker, '89 (V), SM '90, writes: "I got married to Martin Voelker in 1993, finished a PhD at the ETH Zurich in 1994, and am now doing a postdoc at the Woods Hole Oceanographic Institution. I am enjoying life on Cape Cod." . . . From Mexico, **Daniel Lieberman**, SM '83, writes: "In 1984, I established an embossing holographic company called Hologramas de Mexico. We now have around 60 employees and sales all over the world. We are planning to set up a branch near the U.S. border next year and are presently looking for investors or joint ventures." . . . **Steve Lipner**, '65, SM '66, writes: "I am back in the computer security business as the VP of Trusted Information Systems, Inc., of Glenwood, Md. We have about 125 employees, and are privately held (employee owned). Our Internet product, Gauntlet, is getting a very good reception. Far and away, it's the most successful security product I've ever been responsible for. The only downside of the new job is commuting 43 miles each way, part of it on the dreaded D.C. Beltway."

Eva Lerner-Lam, SM '78, writes: "I'm working with the Beijing Highway Bureau and travel there once every two months for two to three weeks." . . . **Charles C. Ladd**, '55 (XVII), SM '57, ScD '61, of Concord, Mass. announces: "In May 1994, I was the first recipient of MIT's Samuel M. Seegal Prize for 'inspiring students in pursuing and achieving excellence.' In July 1994, I became the Edmund K. Turner Professor of Civil and Environmental Engineering. I completed my term as chair of ASCE's Geotechnical Engineering Division Executive Committee. I was also the U.S. delegate to the 13th International Conference on Soil Mechanics in New Delhi, which led to lectures in Bangkok and Taipei."

From Atkinson, N.H., **Gino J. Barone**, SM '80, writes: "Beacon Construction Company promoted me to executive VP and COO for construction operations. I have been with Beacon since graduating in 1980 and have been involved with projects such as the One Post Office Square Complex and the Rowes Wharf Complex. In addition to my executive duties, I am currently involved in the Terminal B Expansion of American Airlines at Logan Airport and the Warren B. Rudman Federal Courthouse in Concord, N.H. Of particular satisfaction this year was the construction of the Boston Harborlights Pavilion project." . . . From Virginia Beach, Va., **David C. Campbell, Jr.**, SM '89, reports: "I got out of the Navy in April 1994. I then hiked the Appalachian Trail from Georgia to Maine—2,155 miles in six months!"

After 37 years of teaching at Lehigh University, **Alexis Ostapenko**, ScD '57, retired in September 1994. Ostapenko attributes his length of service to the university's location in Bethlehem, Pa., its "people-mode of operation," and the challenging and exciting work he pursued in the facilities of Fritz Lab. His research on the buckling and post-buckling strength of steel-plated structures, including ships, bridges, and both damaged and undamaged offshore platforms, has contributed to new specifications for steel structure design during the past 30 years. Ostapenko reports that one of the most important aspects of his time at Lehigh was his work with students—seeing them grow and learning to motivate them without "breaking" them. He advises younger faculty members to "pay attention to the students" and believes that an effective teacher must engage in two-way communication with students throughout the semester. His retirement will include some relaxation and time with his family and more research, including a project in offshore corroded tubular structures.



Alexis Ostapenko

Thomas T. Jones, SM '54, died July 8, 1994, at the Veterans Hospital in Martinsburg, W.Va. He had Alzheimer's disease. Colonel Jones, an Illinois native, served in the Army during World War II. In 1948, he graduated from the U.S. Military Academy at West Point and then went to Japan. He was sent to South Korea after the invasion by North Korea, was captured in the fall of 1950, and later escaped with three other soldiers. After Korea, Jones's assignments included tours as an instructor in the Military Art and Engineering Department at West Point and the command of a combat engineer battalion. His military awards included the Distinguished

DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering
ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering
MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science

Service Medal, the Bronze Star with combat "V" for valor, the Legion of Merit, and two Army commendation medals. He was serving on the staff of the Army chief of staff when he retired from active duty in 1970. He then worked for the Federal Reserve Board until 1984. . . . **Thomas E. Cheyer**, SM '65, senior VP and a partner at Camp, Dresser and McKee, died on April 18, 1994, at his home in Sharon, Mass. Cheyer, a native New Yorker, designed water distribution and treatment systems in Bangkok and Cambridge, among other places. . . . The Association of Alumni and Alumnae has been notified that **Alfred T. Waidelich**, SM '30, died on November 28, 1994. No further information was provided.

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II MECHANICAL ENGINEERING

"After 15 years in the Boston area," writes **Elaine Lee**, '84, SM '86, "I may finally be leaving. I'm hoping to graduate in June 1995 with a PhD from Health Sciences and Technology (HST), though it could take me until August. I'm looking for a postdoc position or another job at Virginia Tech, so that I can join my boyfriend, Pui Ho W. Tsang, PhD '94 (XVI) in the bucolic, low-stress, no-Boston-drivers-around, green hills of western Virginia." . . . From Milton, Vt., **Katherine C. Norris**, SM '67, writes: "I am serving as scholarship chair for the Society of Women Engineers for the third consecutive year. The scholarship program has increased to over $100,000 annually at this time." . . . **Robert J. Alexander**, SM '91 (II, XV) announces: "I recently joined Hidden Hitch International, an auto-parts company, as president. I have two great children, Chelsea, 2½ years old, and Luke, 8 months old." . . . At the Technical University of Nova Scotia, **Adam C. Bell**, SM '66, ME '68, ScD '69, was named dean of engineering on July 1, 1994. He had been the head of mechanical engineering. . . . From Menlo Park, Calif., **Bill Verplank**, SM '67, PhD '77, writes: "I'm into the third year of my 'dream' job at Internal Research doing interaction design and haptics research. I'm helping Terry Winograd, PhD '70 (XVIII), with an interactive design 'studio' course at Stanford." . . . **Peter Meckl**, SM '84, PhD '88, was promoted to associate professor of mechanical engineering at Purdue University on July 1, 1994. Meckl teaches courses in microprocessor and vibrations control. He received his bachelor of science in mechanical engineering at Northwestern University. He is married to Marie Peters and has two children, Paul, age 6, and Kristina, age 2.

From Washington, D.C., **Steve Taub**, SM '94 (II, TPP) writes: "I am working for the Department of Energy's Environmental Management Program. We are responsible for cleaning up the DOE's nuclear weapons plants and managing the wastes." . . . At the University of California/Santa Barbara, **Monique S. Gaffney**, SM '90, is working on a PhD in electrical and computer engineering. . . . **Afarin Bellisario**, ScD '80, SM '90 (XV), was recently appointed manager of the Strategic Business Unit for Sound and Vibration Products at Analog Devices. She lives in Boston with her husband, Lee, and their sons, Darin and Sebastian.

Clarence W. de Silva, PhD '79, and **Ronald L. Levin**, '73, SM '73, ScD '76, were recently named Fellows of the American Society of Mechanical Engineers. De Silva, a resident of Vancouver, Canada, is senior chair in industrial automation at the Natural Sciences and Engineering Research Council of Canada, located at the University of British Columbia. In addition to his numerous contributions to education and R&D, he has published textbooks and self-study courses that are used worldwide. Currently, he is leading a major effort to automate the fish-processing industry. Levin, who resides in Olney, Md., is a biomedical engineer for the National Institutes of Health. An expert in the application of thermodynamics and heat and mass transfer, he has made numerous seminal contributions in cryobiology and hyperthermia therapy for tumors. . . . Citing his contributions to tribology, materials processing, and manufacturing, the Korea Broadcasting System has selected MIT Professor **Nam P. Suh**, '59, SM '61, as a recipient of the 1995 Distinguished Overseas Korean Prize. Suh, the Ralph and Eloise Cross Professor of Manufacturing and head of the Department of Mechanical Engineering, was also recognized for his accomplishments in establishing university-industry research programs and for his commitment to public service. . . . **P. Ranganath Nayak**, SM '65, ME '67, ScD '68, a senior VP at Arthur D. Little, Inc., has co-written *Product Juggernauts: How Companies Mobilize to Generate a Stream of Market Winners* (Harvard Business School Press, 1995) with Jean-Philipe Deschamps, another VP from ADL. *Product Juggernauts* is grounded in the authors' years of hands-on consulting experience and features lessons from some of the most famous product creators in the world. . . . **Helmut E. Weber**, '51, SM '51, ScD '55, send us word from San Diego, Calif., that John Wiley & Sons has published his new book, *Shock Wave Engine Design*.



Ronald Levin

A loving tribute to **John William Hansborough**, SM '35, who died after a short illness on July 30, 1993, in Austin, Tex., was written by his son Lash. Born in 1908, Hansborough graduated from West Point before coming to MIT, where his thesis subject became one of the building blocks used for the spectral composition analysis of stars. In 1938, he graduated from the Field Artillery School in Fort Sill, Okla.; while there, he prepared a study of a lightweight 105mm howitzer, built a model, and submitted it to the chief of field artillery. It subsequently became the famous 105mm howitzer, a mainstay of U.S. artillery in World War II. During WWII, Hansborough was on General George Patton's staff during the invasion of North Africa. While serving with General Mark Clark during the invasion of Italy, Hansborough established the procedures for coordinating air support for army ground forces, a system subsequently employed in the entire European theatre. After returning to the States, Hansborough held various positions in the military, including service as chief of staff of the Army in Alaska and commander of the 34th Field Artillery Brigade in Fort Hood, Tex. After retiring from the military in 1961, he and his wife settled in Austin. For the next 10 years, he taught science courses at Saint Edward's University. He also developed an interest in genealogy; two of his genealogy books are in the Library of Congress. At the time of his death, Hansborough was writing his autobiography. . . . **Deevendra D. (Dave) Mehta**, SM '68, died on November 6, 1992. A native of India, Mehta had resided in Windsor, Conn., for the past 17 years, where he worked as an engineer for ABB Combustion Engineering. He was an active member of the Windsor Soccer League and regularly attended local MIT activities.

William L. McCulla, SM '36, died on March 5, 1994, at Largo Medical Center Hospital in Florida. McCulla, a native of Cherokee, Iowa, and a 27-year Air Force veteran, was a 1929 graduate of the U.S. Military Academy at West Point. He was a member of the West Point Society, Florida West Coast, National Defense Preparedness Association, the Air Force Association, and the American Arbitration Association, among others. . . . **Gorken Melikian**, SM '57, manager of environmental systems and technology for United Technologies Research Center in East Hartford, Conn., died on October 11, 1993, after a short battle with thyroid cancer. . . . The Association of Alumni and Alumnae was notified of the deaths of **Gardner M. Ketchum**, '41, SM '44, ScD '49, and **Paul J. Kiefer, Jr.**, '47 (XIX), '49, SM '49. Ketchum, who died on September 25, 1994, lived in Alexandria, Va., and was a professor emeritus at Union College. Kiefer died on January 19, 1994, and was a resident of Annapolis, Md.

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III MATERIALS SCIENCE AND ENGINEERING

Vivek R. Davé, SM '91, of Franconia, N.H., reports that he finished a PhD in Course III at MIT at the end of January and is graduating in June 1995. . . . From the Big Apple, **Joan Adams**, SM '80, writes: "I have entered the brave new world of consulting via EDS Management Consulting. I have been here as a senior consultant for a year and look forward to being a managing consultant very soon. My specialization is business-process reengineering. My industry has been a mixed bag of entertainment manufacturing and retail marketing." . . . "After working for IBM for three years doing research on 256 Mbit DRAM, I left to join the Center for Naval Analyses in Alexandria, Va.," writes **Julius C. Chang**, '82, SM '82, PhD '89. "For the past two years, I have worked on various electronic warfare projects for the U.S. Navy. I recently accepted a two-year field assignment at NAS Whidbeg, Wash., as the CNA representative to COMVAQWINGPAC. Basically I provide technical analyses and assistance to the EA-6B prowler wing. Interested parties can e-mail me at <jchang@whidbeg.net>.

"I have moved to Richmond, Va.," writes **Thomas R. Clevenger**, ScD '61, "where I hope to continue consulting on Japanese and Far East business matters. My son, **Douglas Clevenger**, '88 (XV), tells me I will soon be a grandfather. Time passes too quickly!" . . . **Jack H. Westbrook**, ScD '49, president and

principal consultant with Brookline Technologies in Ballston Spa, N.Y., and **Robert L. Fleischer**, a former assistant professor in the Department of Metallurgy at MIT, have coedited a new treatise for John Wiley and Sons, of Chichester, UK, entitled *Intermetallic Compounds—Principles and Practice*. The 2-volume, 75-chapter, 1,900-page treatise includes contributions from 100 scientists and engineers from 14 countries in addition to the United States. Other MIT graduates who contributed to the treatise include **A.J. Ardell**, '60, and Z.J.J Stokly, '55 (II), SM '55 (II, VI), ScD '59 (II). The book is dedicated to the late **J. Herbert Hollomon**, '40 (VIII), ScD '46, a former professor of engineering at MIT and director of the Center for Policy Alternatives.

The International Organization for Crystal Growth has awarded the 1995 Laudise Prize to **Robert Feigelson**, SM '61, for his contributions to the field of experimental crystal growth. Feigelson is a professor in the Department of Materials Science and Engineering at Stanford University. . . . **Roland T.C. Choo**, ScD '91, writes: "I have joined Concurrent Technology Corp. as a technical staff member in the casting department."

From Clayton, Miss., **Anton De S. Brasunas**, ScD '50, writes: "I'm on the board of the U.S. Metric Association, serving as chair of the committee to certify 'metric specialists.' Since President Clinton signed the Educate America Act: Goals 2000, it is felt that accurate information on proper usage will be vital."

At Northeastern University in Boston, **Charles W. Finn**, PhD '71, has been appointed the director of the School of Engineering Technology. Finn was most recently an associate professor of mechanical engineering with primary responsibilities in the materials area. He will continue his association with the ME department as an adjunct professor. Finn, who also holds a BS from Northeastern University, has previous teaching experience at Curtin University in Australia and at the University of Witwatersrand in South Africa. His other experiences include major stints in the Australian steel industry and as director of research of Vacuum Industries, Inc., in New England.

F. William Bloecher, SM '49, died February 28, 1993, in Sarasota, Fla. **Edward S. Frohling**, '48, of Tucson, Ariz., writes: "Bill retired from his consulting firm, Marsh Gibbon, in 1987, but spent most of his career with American Cyanamid. He started with the company in 1952 in Watertown, Mass., working on an Atomic Energy Commission project. Later, he sold mining chemicals, and then transferred to the raw materials department and traveled around the world on the company's behalf. Bill graduated from Lehigh University as a mining engineer in 1944. I met him when he went to MIT to obtain an SM in metallurgy. He was a good student, studying under the great **Tony Gaudin**, but he was also a great shortstop on our softball team. Bill had a heart problem, diagnosed in his early twenties, but that never slowed him down one bit. The only trouble was that we lost a good cleanup man on the ball team. Bill married Eleanor Cresswell of Steelton, Pa., in 1944. If there were any two people more devoted to each other, I have yet to meet them. Bill was a member of AIME for 49 years, the Mining Club of N.Y., and the West Side Presbyterian Church of Ridgewood, N.J. Bill was a great guy, had loads of friends, and will be missed. He fooled us all. We thought he was sick all those years, but he beat the odds and lived a long life. We miss him now, particularly his devoted wife, Eleanor." . . . The Association of Alumni and Alumnae has been notified of the death of **Alan Lee Titchener**, ScD '58, of Auckland, New Zealand, on June 23, 1994. Titchener's publications include two reviews of *The Stored Energy of Cold Work*, one with Professor **Michael B. Bever**, SM '42, ScD '44, and the second with Bever and **David L. Holt**, ScD '58. Titchener retired as professor of chemical and materials engineering and head of the department and dean of engineering at the University of Auckland.

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IV ARCHITECTURE

David R. Borenstein, MAR ' 84, writes that he is an architect and lives in Red Hook, N.Y. . . . **Robert R. Ream**, SM '86, is a real estate consultant for nonprofit organizations and a developer of affordable housing. . . . **Harold R. (Chip) DeMoss III**, SM '88, announces his new position of general manager of the Commercial Division at GPM, Inc., in Galveston, Tex. He writes: "GPM is the asset management and development arm for commercial properties in Galveston owned by George P. Mitchell. The portfolio includes retail, office, and residential properties that are located in the Strand Historic District, the Wall Street of the South in the late 1800s." . . . **Muhammad H. Awni**, MAR '79, was recently promoted to chief of the energy services branch of the Walter Reed Army Medical Center in Washington, D.C. In June 1993, he earned a master's degree in real estate and urban development from American University.

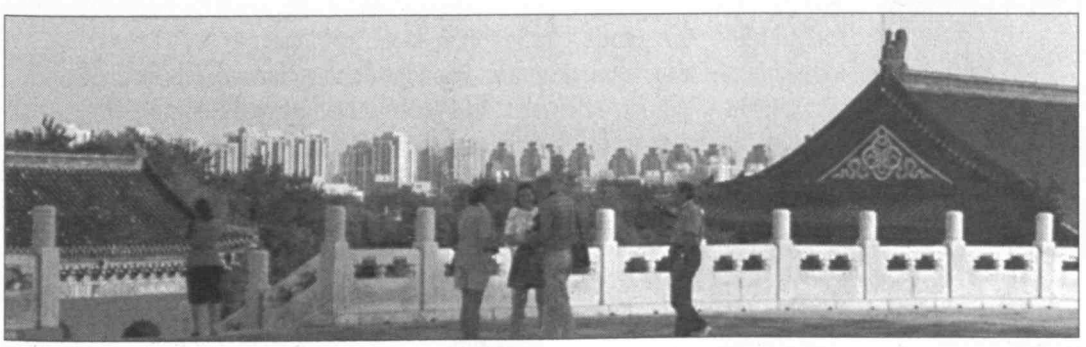
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V CHEMISTRY

News from **Ernest J. Friedman-Hill**, PhD '92: "I recently became a senior member of the technical staff at Sandia National Laboratories in Livermore, Calif. I work in the Center for Computational Engineering and am working on information technologies as well as quantum chemistry." . . . Bristol-Myers Squibb Co. of Princeton, N.J., has announced the appointment of **Mark L. Lee**, PhD '76, to the position of VP for licensing. In his new position, Lee will have responsibility for worldwide product licensing initiatives for the Pharmaceutical Group, including patent and product licensing, co-development, co-marketing and supply agreements, and product-based strategic alliances. Prior to this appointment, Lee served most recently as senior director of business development for the company's intercontinental region, as well as having worldwide responsibility for business development initiatives in support of several therapeutic area franchises. Before joining Bristol-Myers Squibb in 1986, he held research positions with Sando Pharmaceuticals. . . . **Stefan H. Unger**, PhD '71, writes: "I founded BioSoftware Marketing in March 1994 for retail technical software sales, marketing, consulting,



Mark Lee



Samuel C.M. Wang, MAR '62, writes: "I traveled to China, Hong Kong, Indonesia, and Singapore in September and October 1994. I visited the architecture department of Tsinghua University in Beijing. The assistant dean, Professor Sun, is currently a visiting scholar at the Harvard Graduate School of Design. I saw 'cookie cutter' high-rise structures throughout the Forbidden City. Here is a view of the repetitive modern skyline as seen from the Old Palace. It triggered some ambivalent feelings."

and brokering in the drug design area." . . . From Lincoln, Mass., **Scott M. Rocklage**, PhD '82, writes: "I am currently president and CEO of Cubist Pharmaceuticals in Cambridge, Mass. Cubist is focused on developing novel anti-infectives to combat the significant rise in drug-resistant pathogens. Prior to Cubist, I spent 13 years (post-PhD) in California at Catalytica and Salutar. I returned to Massachusetts in June 1994. . . . We accidentally misidentified **Karen Root Caldwell** in the February/March 1994 issue. Caldwell, PhD '83, reports: "On September 1, 1994, I began an appointment as assistant professor in the Department of Chemistry and Physical Science at Pace University's Pleasantville campus. "

From New Orleans, **Joel T. Mague**, PhD '65, announces: "I was appointed chair of the chemistry department at Tulane University effective July 1, 1994, for a three-year term." . . . **Peter McCarthy**, PhD '85, was recently promoted to assistant director of medical chemistry at Pfizer Central Research in Groton, Conn. McCarthy is involved in discovery research on atherosclerosis, diabetes, obesity, and osteoporosis. . . **J. Throck Watson**, PhD '65, reports: "I am on sabbatical leave from Michigan State University to investigate ion/molecule reactions in the gas phase by mass spectrometry at the Ecole Normale Supérieure in Paris. . . . From Wynnewood, Pa., **George A. Frank**, PhD '65, announces: "I was elected to the council of the Intellectual Property Law Section of the American Bar Association for a four-year term (1994–98) at the ABA's annual meeting in August 1994."

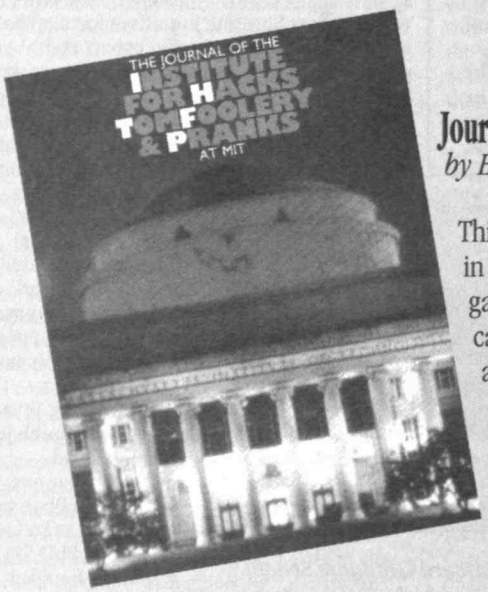
Carlton C. Gordon, SM '24, of DelMar, N.Y., died in January 1993 after a brief illness. He was born in Hazardville, Conn., and had lived in DelMar since 1932. He was a 1922 graduate of Wesleyan University. For 43 years, Gordon was a research chemist with Albany International. He was a communicant of the First United Methodist Church, DelMar, where he was a former board member, music committee member, and Sunday-school superintendent. He was a member and past president of the Albany Camera Club and had taken many award-winning photos. He was also a former cellist with the DelMar Men's Orchestra, a former member of the Bethlehem Environmental Committee, and a volunteer driver for the American Red Cross. . . . In April 1994, we reported the death of **Clarence (Bud) Morehouse**, PhD '47, on September 25, 1993, in Orlando, Fla. We recently received biographical information on Morehouse. He was also educated at Tufts University and McGill University. During his career, Morehouse was VP and general manager of the International Division of Globe Union, Inc., as well as positions with the National Bureau of Standards, Olin Industries, and RCA. Morehouse was a member of Electrochemical Society, American Chemical Society, SigMa Xi, and Alpha Chi Sigma. . . . **Edward S. Mason**, PhD '27, of Barrington, R.I., died of cancer on October 27, 1994. He was a professor at Brown University and held the Newport Rogers Professor of Chemistry Chair from 1983 until he retired in 1992. Previously he had been a professor at the University of Maryland Institute for Molecular Physics and also had been on the faculty of Penn State University. He held a BS from Virginia Polytechnic Institute. Mason made major contributions to the theory of transport phenomena, especially the thermal conductivity of molecular masses. His contributions to transport theory have also resulted in quantitative treatment of gas transport in porous media, now widely used in engineering practice. His most recent work on dense fluids had led to a general analytical equation of state of simple form whose parameters can be evaluated if the intermolecular forces are known. Foremost among Mason's many avocations were English, Scottish, and Morris dancing. He was a member of the Pinewoods Morris Men and the Westerly Morris Men. He danced in the Christmas Revels for many years and attended Pinewoods Dance Camp in Plymouth, Mass., for 42 years.

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VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

John W. Woods, '65, EE '67, SM '67, PhD '70, writes: "I received the Technical Achievement Award, a senior award of the IEEE Signal Processing Society. The award was presented at the First IEEE International Conference on Image Processing last November in Austin, Tex." . . . **David M. Papurt**, SM '79, EE '80, PhD '82, of Brookline, Mass., has written *Inside the Object Model: The Sensible Use of C++* (SIGS Books, January 1995), which is distributed by Prentice Hall . . . "My fifth year of retirement from Hughes Aircraft Co.," writes **George W. LeCompte**, SM '55, "was marked by participation as principal investigator for an SBIR contract at MDE Engineers of Seattle,

Hack \'hak\ *n* **1:** A prank, usually elaborate. *v* **1:** To perform a prank. **2:** To explore the places on campus that are not usually accessible. **3:** To work at or study a subject not especially for academic gain.



Journal of the Institute for Hacks, Tomfoolery, & Pranks at MIT
by Brian M. Leibowitz

This hilarious book recounts the history, folklore, and ingenuity of MIT students in their quest for the ultimate prank. From the famous Harvard-Yale football game to the Great Dome Pumpkin, this generously illustrated "journal" captures all the spirit and playfulness of the most hilarious tradition in academia. *Paperback, 158 pages,* $19.95

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Wash. The task was feasibility demonstration on 'piece-wise video shadow graph' for micron precision inspection of bobbin baselayers for fiber-optic guided missiles."

Ahmed Tewfik, SM '84, EE '85, ScD '87, writes: "I gave a plenary lecture at the IEEE International Conference on Acoustic Speech and Signal Processing in Adelaide, Australia, in April 1994. The topic of the lecture was fractals and scaling signals in digital signal processing." . . . **Zoher Z. Karu**, SM '92, a student in the Course VI doctoral program, turned a small hand-written packet he had prepared for his students when he was head teaching assistant for 6.003 (Signals and Systems) into a book, *Signals and Systems Made Ridiculously Simple*. To publish the book, Karu even started his own publishing company, ZiZi Press, which has an office in Kendall Square. Karu also became a bookseller, setting up shop for a few days in October 1994 outside of the room where 6.003 is taught. Writing, publishing, and selling a book "takes more time than you might expect," he wrote in a brief preface. "If there is one thing I've learned, it's that I have great respect for people who can find the time to write a 700-page textbook." *Signals and Systems Made Ridiculously Simple* is designed to serve as a study guide and reference for undergraduate and graduate students. For more information, contact the author by e-mail at <zzkaru@mit.edu>, via the World Wide Web at <http://www.mit.edu:8001/people/zzkaru/zizi.html>, or by phone at (617) 621-7894.

"1994 was a year of major milestones for my daughters," writes **Carol Lemlein**, SM '83. "Karen Hutchings, a 1986 graduate of Northwestern, married Martin Olivero in June. Sandra Hutchings, a 1990 graduate of Brown University, completed a master of architecture degree at California Polytechnic/Pomona in December." ... From Sherman Oaks, Calif., **Michael Elkind**, SM '71, writes: "I am a partner in the law firm of Robbins, Berliner & Carson. I have been practicing patent, trademark, copyright, and unfair competition law in Los Angeles for the past 17 years. My wife, Carol, my two daughters, Elisa and Judy, and I are enjoying life in Los Angeles despite the natural and man-made disasters." . . . A new book featuring the work of **Harold E. Edgerton**, SM '27, ScD '31,was recently published by the MIT Press: *Seeing the Unseen: Dr. Harold E. Edgerton and The Wonders of Strobe Alley* . . . The Association of Alumni and Alumnae was notified that **Josef Gross**, SM '56, of New Brunswick, N.J., died on December 24, 1993. No further information was available.

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VI-A INTERNSHIP PROGRAM

January IAP is upon us, as I write, and preparations are in full swing for another VI-A recruiting season starting with the traditional 'VI-A Orientation Lecture' on February 8 in Edgerton Hall, to be given this year by VI-A's new director, Professor **Markus Zahn**, '67, SM '68, EE '69, ScD '70. Customarily 150–200 Course VI sophomores attend.

Professor Zahn tells me, as of this writing, he expects there'll be 60–75 openings for this year's VI-A class. More accurate statistics will be available by the time of the annual VI-A business meeting in March '95.

To help with the tuition requirements for the graduate phase of VI-A, Professor Zahn is inaugurating a new VI-A Fellowship Program that, at a minimum, will match the financial terms of a research assistantship. Because the tuition is covered with a minimum stipend matching that of a research assistantship, this fellowship has great value to VI-As in their graduate year with only a minimal additional expense to the VI-A participating companies. He hopes that many VI-A companies not already awarding this graduate assistance will decide to participate.

It's always a pleasure to acknowledge departmental faculty and graduates elected to the grade of Fellow by the IEEE. This year's honorees include four faculty members: **Harold Abelson**, PhD '73 (XVIII), **Arvind, Jeffrey H. Shapiro**, '67, SM '68, EE '69, PhD '70, and **Charles G. Sodini**; one MIT principal research engineer: **Stephen D. Umans**, '70, SM '72, EE '73, ScD '76; and one VI-A alum: **Gary K. Montress**, '71, SM '71, EE '71, PhD '77, who is with the Research Division at Raytheon Co. Our hearty congratulations to them all!

Also, VI-A alum and faculty member **Alvin W. Drake**, '58, SM '58, EE '61, ScD '62, has been appointed the Ford Professor of Engineering in the EECS Department, a chair "awarded to outstanding faculty in recognition of special accomplishments." Professor Drake is widely known for his innovative teaching of applied probability and his mentoring of graduate teaching assistants, acknowledged Dean of Engineering **Joel Moses**, PhD '67 (XVIII).

Although officially retired, I still receive Christmas cards from alums with whom I became acquainted when I was VI-A director (albeit fewer in number each year). This year's list includes: **Geoffrey J. Bunza**, '74, SM '77, EE '78, PhD '81; **John F. Cooper**, '74, SM '76; **Edward C. Giaimo**, '75, SM '75; **David L. Lyon**, '70, SM '70, PhD '72; **James E. Mandry**, '81, SM '83 (who mentions that **Steven K. Ladd**, '81, SM '81 is president of InterChip Systems, Inc., where he works in Hudson, Mass.); and **Paul E. Stoft**, SM '49, EE '51, ScD '55, who retired from H-P/Palo Alto.

A letter from **Claude L. Parish**, SM '38, to Department Head **Paul L. Penfield, Jr.**, ScD '60, opens with: "I was a VI-A graduate student from June 1937 until October 1938—probably the most valuable education of my life." He further mentions that "the course that made the greatest impression on me was Transients in Linear Systems, taught by Professor **Murray F. Gardner**, SM '24." Such comments spur us on to keep VI-A a viable engineering experience in this rapidly changing world.

Visitors signing our guest book include: **James E. Goldinger**, '93, SM '93, from Boynton Beach, Fla., working with Motorola, Inc., who introduced his fiancée; **Steven T. Kirsch**, '78, SM '80, from California, who told me he's starting a new company named InfoSeak Corp.

Remember, I do read my e-mail if you're so equipped—John A. Tucker, director (emeritus) and lecturer, VI-A Program, MIT, 77 Mass. Ave., Rm 38-473, Cambridge, MA 02139-4307; e-mail: <jat@fenchurch.mit.edu>

VII BIOLOGY

"Who's left from my era?" asks **Richard S. Gordon**, PhD '54. He writes: "Old age brings awards: the Brian Davidson award from Har-

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vard Business School and the Faculty/Alumni Teaching Award from Arizona State University." Gordon explains that his research is now "focused on fundamental and applied questions associated with multiple use of scarce desert resources; development work is concerned with USAID sponsorship of privatization of food and agribusiness enterprises in Eastern Europe and Africa. New crops of graduate students keep one young." . . . **Barbara R. Baumstark**, PhD '76, is the director of the Biotech and Drug Design Research Center at Georgia State University.

Our condolences go to **David S. Stuart**, '72, SM '72, of Vancouver, B.C., who writes: "My wife, Trudabeth Gail Mah, died October 11, 1994. My son, Colin, is five years old.". . . **Irving Gray**, PhD '48, a retired Army colonel who was also a Georgetown University biology professor emeritus, died of cancer December 17, 1994, at Georgetown University Hospital. He had lived in Bethesda the last 30 years. Gray entered the Army during World War II and was commissioned in the Medical Service Corps. He was a D-Day company commander on the stretch of Normandy Beach that became known as Utah Beach. Cornelius Ryan, in his history of the landings, *The Longest Day*, wrote of the prayer Gray had a chaplain offer as the men were readying themselves to hit the beach: "To the God in whom we all believe, whether Protestant, Roman Catholic, or Jew, that our mission may be accomplished and that, if possible, we may be brought safely home again." President Clinton quoted the prayer in his speech commemorating the 50th anniversary of the landings and those lost in the assaults. Gray ended the war as a battalion commander in the 4th Infantry Division. He briefly took up civilian life before returning to active duty in 1948 at what is now the Walter Reed Army Institute of Research. In 1956, he transferred to the Quartermaster Corps. He retired in 1964 from active duty as physical sciences division chief of the Army medical unit at Fort Detrick, Md. His military decorations included the Silver Star, two Bronze Stars, two Purple Hearts, and the Combat Infantryman's Badge. He taught at Georgetown from 1964 to 1990. Gray wrote technical articles on biochemistry and radiation biology. He was a Fellow of the Washington Academy of Sciences and an editor of its journal.

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VIII PHYSICS

From the Boston College Department of Physics, Professor **Baldassare Di Bartolo**, PhD '64, writes: "I will direct a NATO Advanced Study Institute, "Spectroscopy and Dynamics of Collective Excitations in Solids," at the Ettore Majorana Centre in Erice, Italy, from June 17 to July 1, 1995. . . . News from Lieutenant Colonel **William D. Horton**, SM '79: "I am working on projects that will apply electro-optical and infrared warning receiver and countermeasures to Army and Marine Corps vehicles. Our focus is to protect soldiers from attack by advanced weapon systems. We do this by exploiting weaknesses inherent in the design of target acquisition and fire control systems. So far, we've been successful in showing how we can beat a number of advanced weapons (U.S. and foreign). I also taught a graduate-level engineering course in electro-optical and infrared countermeasures last year at the University of Michigan and have been asked to teach the course again next summer. . . . **Vasilios Vutsadakis**, PhD '92, has a private consulting practice and is active in technology transfer between Eastern Europe and western companies. . . . An update from **Arthur W. Winston**, PhD '54, a senior associate director of The Gordon Institute: "I have been elected a director for Region I of the Institute for Electrical and Electronic Engineers (IEEE) representing the group's 55,000 members in N.Y., N.J., and New England. I will serve as director-elect beginning in 1995 and as director through 1997. I am a Fellow of the IEEE and have also been active in MIT events including Technology Day, Seminar Series, and the MIT Club of Boston. The IEEE is the world's largest profession organization with 320,000 members."

Thomas P. Sheahen, '62, PhD '66, sends word: "In October 1994, Plenum Press published my new book, *Introduction to High Temperature Superconductivity*. It's a tutorial book aimed at engineers/scientists who are not familiar with each of the specialties that make up this field.

Henry A. Morss Jr., PhD '36, of Hardwick, Mass., died on November 17, 1993. Morss earned an AB in mathematics from Harvard in 1932. He worked at Simplex Wire and Cable Co. from 1936 to 1958. From 1959 to 1972, Morss worked in the MIT Department of Geology and Geophysics as an assistant to the department head. During the first four years of his service to MIT, Morss represented the members of the departments of meteorology and of geology and geophysics during the design, construction, and occupancy of their new building, the Green Building. His keen interest in sailing and multihulls (in particular trimarans) led to a book called *Design for Fast Sailing* co-written with Edmond Bruce.

George William Mahlman, ScD '48, of Newport Beach, Calif., died March 7, 1994, from a stroke after a short illness. He graduated from the University of Michigan in 1941 as an engineering physicist. Following service in WWII and employment on the East Coast, he moved to California in 1957 and worked at various aerospace companies in Malibu, Palos Verdes, and Orange County. Mahlman was always interested in science and astronomy. He belonged to the Buffalo Telescope Makers at age 15. After retiring, Mahlman enjoyed golfing, painting, traveling, and building telescopes. He developed his talent in watercolor painting through classes and workshops at Coastline College, where he and his wife, Ruth, painted, entered shows, won awards, and sold pictures. He also collected stamps, liked gardening, and was learning to cook. Mahlman and his wife had been married one month short of 51 years at the time of his death.

Timothy R. Hart, PhD '70, of Maplewood, N.J., died on April 6, 1994. He was a professor of physics and dean of research at Stevens Institute of Technology in Hoboken, N.J., where he had been on the faculty since 1970. He had also been a consultant for Bell Laboratories, U.S. Testing Co., and Picatinny Arsenal. . . . **Michael A. Guerra**, SM '69 (VI), PhD '76, founder and CEO of Ibis Technology Corp. in Danvers, Mass., died of a brain tumor on May 21, 1994, at his home in Exeter, N.H. No further information was available.

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IX BRAIN AND COGNITIVE SCIENCES

Michael P. Stryker, PhD '75, writes: "I have been appointed chairman of the Department of Physiology at the University of California/San Francisco. My wife, Barbara Poetter, and I will have our fourth child soon."

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X CHEMICAL ENGINEERING

Harvey Stenger, ScD '84, was appointed dean of the College of Engineering and Applied Science at Lehigh University effective November 1, 1994. He had served as interim dean since the death of the former dean in November 1993. Lehigh Provost Alan W. Pense praised Stenger's efforts to encourage engineering professors to help recruit freshmen by writing letters and interviewing prospective students. Stenger, 37, is the youngest person to serve as dean of engineering in Lehigh's history. He said one of his goals would be to promote such programs as studying abroad and cooperative learning programs. Stenger joined Lehigh's faculty in 1984 and directed the university's Environmental Studies Center from 1991 to 1993. He conducts research in the areas of selective catalytic reduction, destruction of chlorinated hydrocarbons, and on-line optimization of semi-batch reactors. Stenger and his wife, Cathy, live with their two daughters in Coopersburg. . . . **David S. Hacker**, SM '50, writes: "I recently retired from Amoco Corp., where I was supervisor of the thermophysical properties laboratory. I will now establish a not-for-profit center at BIRL/Northwestern University for the measurement of thermophysical properties and evaluation of hazardous chemical systems. These services will be available on a time and materials basis. Where new apparatus is required, some cost will be borne by the client." . . . From North Carolina, **Joseph E. Leitgeb**, SM '57, writes: "My wife, Mary, and I have just moved into our newly constructed custom home in northern Durham. We are thoroughly enjoying retirement. Playing golf, traveling, dining out, and decorating our new home occupy most of our time."

Edgar B. Gutoff, SM '52, ScD '54, was awarded the John A. Tallmadge Award for contributions to coating technology for his work furthering "the understanding or improvement of the coating or continuous webs in all its aspects." The award is sponsored by the AIChE National Program Committee Area 1k on Coating Process Science and Technology, a group that he formerly chaired. Gutoff began his career with Brown Co. (now part of James River). He then worked for Ionics, and later joined Polaroid, where he served in several capacities, including senior principal engineer, until retiring in 1988. Gutoff is the author of several technical papers. Since 1981, he has been a part-time lec-

turer, adjunct professor, and visiting research professor at Northeastern University. He is also an adjunct professor at Tufts University. An AIChE Fellow, Gutoff organized the first AIChE International Coatings Symposium. He also presents continuing education courses on the technology of thin film coatings and on coating and drying defects.

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X-A PRACTICE SCHOOL

"Problem-solving is still MIT's calling card," wrote John Powers in a big *Boston Globe Magazine* story about the Institute last winter. (*See the April 1995* TR, *p. MIT 8–14, for complete text of the article.*) "We want to produce students who are ready to go to work," Professor of Physics Robert Jaffe, chair of the faculty, told Powers—"students who have creativity, a long-range view, and analytical skills to solve the hard problems they'll encounter." What better advocacy for the Practice School?

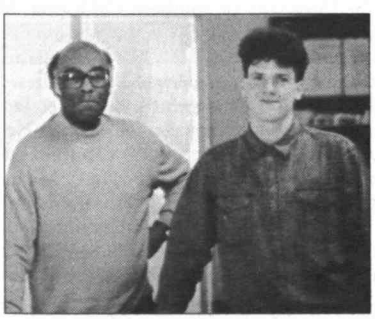
Nor could you ask for better evidence of the breadth and competence of today's X-A students than the news of **Hiroshi Saito**, SM '91, PhD '95. The day after he successfully defended his doctoral thesis last January, Saito set out for a job in the Fundamental Research Laboratory, Energy Resources Department, in Japan's National Institute for Resources and the Environment in the science complex at Tsukuba. Or take **Carlos Rojas-Guzman**, SM '91, PhD '95, who defended his thesis on probabilistic model-based fault diagnosis of chemical processes last December and promptly returned to his homeland to work for McKinsey and Co. in Mexico City. . . . **Gabriel Worley**, SM '89, PhD '94, started last January as senior research engineer at Union Carbide in Bound Brook, N.J. As of the start of the year, he and Peggy Scollins planned to be married in April at the bride's home in Purchase, N.Y.

David B. Rubin, SM '75, writes from South Orange, N.J., that he is now project manager with the firm of URS Consultants in Paramus, responsible for hazardous-waste remediation projects. . . . Since leaving MIT, **Brian Smiley**, SM '83, has made a major career change: he's now manager of the product marketing organization for Apple Computer's PowerBook with headquarters in Palo Alto.

From Edgewater, N.J., where he is senior research engineer at Unilever Research U.S., **Peter Ronco**, '92, SM '93, reports by e-mail to Carol Phillips in the SCEP office that he and **Michelle Toyofuku**, '92, SM '93, "are now engaged and plan to marry next November 11 in Hawaii. Since April [1994], Michelle has been an engineer for EA Engineering, Science, and Technology in Berkeley Heights, N.J. Prior to moving here, she had been working for Brewer Environmental in Honolulu.". . . And three recent Practice School people have started families: As of last December, **Paschalis Alexandridis**, SM '90, PhD '94, and Marina Tsianou were parents of a girl in Lund, Sweden, where Paschalis is a post-doc at the University of Lund. **Colleen Kelly Vandevoorde**, SM '93, and her husband, Mark, are the parents of Christine Michelle, born last January 13 in Boston; Colleen will resume graduate work with Professors **T. Alan Hatton** and **Robert E. Cohen** at MIT this summer after a six-month leave of absence (she was assistant director of SCEP's Natick Station last summer). Nicola and **Paul Nealey**, PhD '94, are the parents of Isaac Conrad. Nealey, now a post-doc in chemistry at Harvard, was assistant director of the West Point Station (Merck) in the 1991 Fall Term.

Frederick H. Reed, '24, SM '25, died last October 20 in Cornwall, N.Y. Reed entered MIT from a private school in Chattanooga, Tenn., and his entire professional career was devoted to technical management in Kodachrome and other emulsion production at Eastman Kodak in Rochester, N.Y. Reed retired in the late 1950s to Cypress Gardens, Fla., where he lived until 1990.

Send news to the undersigned or to Carol Phillips in the SCEP office, MIT Room 66-309 or <carol@pracschool.mit.edu>.—John Mattill, *Technology Review*, MIT Room W59-200, Cambridge, MA 02139



Samuel J. Cullers, MCP '52 (left), of Sacramento, Calif., returned from Hungary where he served as a volunteer with the International Executive Service Corps (IESC). Cullers, president of Samuel J. Cullers & Associates, Environmental and Economic Planning Consultants, was recruited by IESC to assist Ozd REGIO Structure-Development, Ltd. Cullers assisted REGIO in identifying existing facilities and land areas for possible commercial or manufacturing use, placing the information within a computerized system, and drafting a brochure to sell these sites to foreign investors. Cullers is shown with Istvan Vitalis, program manager of REGIO Ozd Structure-Development, Ltd.

XI URBAN STUDIES AND PLANNING

Rolf Goetze, PhD '70, writes: "As we seem to have lost our commitment to understand and deal with housing issues (e.g., condo conversions, co-ops, rent controls, community land trusts), I have shifted to desktop mapping—a terrific tool to reveal socio-demographic patterns and changes. Scanned images of plans, sketches, and development alternatives can be overlaid on the base maps readily available from government sources. Great fun!" . . . News from **Aurelio Mendenez**, PhD '90: "Our child is already nearly two years old. We are expecting

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our second child!" . . . From Washington, D.C., **Gilberto E. Chona**, MCP '91, writes: "I'm currently a programming officer with the Inter-American Development Bank. Since 1993, I have participated in the process of identifying future lending priorities and amounts for development loans in Costa Rica, Honduras, and, most recently, Mexico." . . . **Gene Milgram**, MCP '75, writes: "Many changes—my 15-year job with the State of New York is ending, and I'm also getting married to a woman who is a lieutenant commander in active U.S. Navy service." . . . **David S. Flad**, MCP '83, sends word: "I'm currently a VP of the Boston Financial Group in Boston. It's a full-service real estate investment firm that syndicates low-income-housing tax credits and manages over 30,000 multi-family units in 26 states. I'm also on the board of directors of the Stone Environmental Schools of New England."

"Since July 1994, I have been the program director of Lead-Safe Cambridge," writes **Susanne Rasmussen**, MCP '89. "The program, which is implemented by the City of Cambridge, assists property owners in eliminating lead-paint hazards from their properties. The program aims to de-lead 300 dwelling units over a two-year period. I am enjoying my new job a lot. If you would like to hear more information about the program, please call (617) 349-LEAD." . . . From Washington, D.C., **Israel Stollman**, MCP '48, writes that he is now executive director emeritus of the American Planning Association.

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XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

Pam Melroy, SM '84, writes: "After two and a half years of work as an Air Force test pilot, I have been selected by NASA as a pilot astronaut. I wish to thank my friends and professors who supported and encouraged me throughout the years". . . . News from **David Fitterman**, PhD '75: "I have completed four years as a manager with USGS and now return to research. I plan on spending a lot of time working on an airborne geophysical project in the Everglades National Park mapping saltwater intrusion."

Louis C. Raymond, SM '32, died at his home in Chappaqua, N.Y., on October 19, 1994. He received a BS in mining engineering from Oregon State University (OSU) in 1930. After graduating from MIT, Raymond was a teaching assistant at OSU for a year and then spent the next seven years with Mountain Copper Co., Ltd., at its Iron Mountain Mine in Shasta County, Calif., where he was assistant superintendent. In 1941, he took a position as a mineral specialist with the Federal Trade Commission. In 1945, he joined Ford, Bacon, and Davis, Inc., a consulting firm with headquarters in NYC. He working on mining and geological projects in the United States, Canada, Mexico, South America, the Middle East, Africa, and Australia until he retired in 1973. In retirement he had more time for his amateur painting, especially in oils, and he took a course in archeology that led to active participation in that field.

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XIII OCEAN ENGINEERING

"I am now on the faculty of the Naval War College in Newport, R.I.," writes **Peter Tarpgaard**, SM '68 (II), NE '68, PhD '70. "I teach policy analysis to senior and mid-grade officers drawn from all of the military services. It is engineering skills applied in a different way!"

Via e-mail, **Jim MacStravic**, '84, SM '89, writes: "I recently finished the program manager's course at Defense Systems Management College in Fort Belvoir, and am wending my way down to the Fleet Maintenance Office, Atlantic, for a tour under Rear Admiral Clark. I'm participating in NAVSEA's Commander's Development Program, which plucked me from the joys of SUPSHIP New Orleans to spend 30 months wandering around Washington as an average engineer-in-training. Erin and I survived the ED Officers Ball as the token civilians and managed to run into a host of '89ers, typically in line for the bar." . . . **Ki-Han Kim**, SM '75, PhD '77, is serving as a submarine technology manager at the Naval Surface Warfare Center in Bethesda, Md.

Michael J. Briggs, OCE '81, was elected chairman of the Multidirectional Waves Working Group of the International Association of Hydraulic Research. This group includes 11 members from the United States, Canada, the United Kingdom, Holland, Denmark, Norway, Spain, South Africa, and Japan. Mike expects to be traveling a lot in the coming years. . . . News from **Edward Kern**, SM '71, OCE '71, PhD '73: "After I left MIT, I started my own company to develop solar photovoltaic power applications in 1987. After eight years, we have test installations across the country and working relations with 25-plus electric companies. We expect rapid growth to continue." . . . Captain **John F. McGowan**, SM '76, OCE '76, reports: "In September 1994, I became the deputy chief of staff for the U.S. Coast Guard. As such, I will be deeply involved in the re-engineering and reshaping of the Coast Guard for the 21st century." . . . Coast Guard Lieutenant Commander **Stephen C. Duca**, SM '88 (II, XIII) reported for duty at 8th Coast Guard District, New Orleans. He joined the Coast Guard in May 1981.

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XIV ECONOMICS

Leo Brachtenbach, SM '65, sends brief word: "In July 1993, I moved from Iowa City, Iowa to Omaha, Neb." . . . An e-mail note from **Paul Van de Water**, PhD '75, reads: "For the past year and a half, I coordinated the Congressional Budget Office's analyses of health reform proposals. Since December, I have been supervising all of CBO's budget projections and cost estimates in my new position as assistant director for budget analysis. The entire CBO staff aims to serve the new Congress in the same professional, nonpartisan manner that has been our agency's hallmark for almost 20 years."

John A. James, PhD '74, recently edited *Capitalism in Context: Essays on Economic Development and Cultural Change in Honor of R.M. Hartwell* (The University of Chicago Press, 1995).

Robert Agnew, PhD '53, professor emeritus at the Joseph M. Katz School of Business at the University of Pittsburgh, died of cancer on September 6, 1994, at his home in Pittsburgh, Pa. He was 77. After receiving a doctorate from MIT, Agnew taught at the University of Pittsburgh from 1952 until he retired in 1982. During his retirement, Agnew served as a consultant to the Asia Institute of Management in the Philippines.

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XV MANAGEMENT

Via e-mail, **Antonio C.B. Oliveira**, SM '77, writes: "I am moving from São Paulo, Brazil, to Buenos Aires, Argentina, where I am CEO of Banco Itau Argentina S.A., a new subsidiary of Banco Itau S.A., the second-largest private commercial bank in Brazil." Oliveira can be reached by e-mail at <acbolive@pipeline.com>. . . . News from **Robert T. Hickman**, SM '90: "My wife, Paula, and I are pleased to announce that our son, Robert William, was born on October 29, 1994." . . . **David Bolocan**, SM '92, recently joined Mitchell Madison Group, a New York-based consulting company specializing in the financial services industry. . . . From Santa Monica, Calif., **Burt Nanus**, SM '59, announces: "I retired in 1994 after 25 years on the faculty of the University of Southern California. My new book, *Leading The Way*, will be published in 1995."

Donovan B. Moore, Jr., SM '73, writes: "I have joined Trevor, Steward, Burton & Jacobsen, an investment management firm in New York City, as the director of institutional marketing. . . . From Bloomington, Ind., **Michael Peterson**, PhD '92, reports: "I married Sarah L. Mather on May 29, 1993. Our son, Colin, was born on June 21, 1994. I'm leaving my teaching post at the Indiana University School of Public & Environmental Affairs for a position starting in the summer of 1994 with McKinsey & Co. in New Jersey. . . . From Germany, **Stefan Thomke**, SM '93, writes: "In November 1994, we had our second son, Vikram. In December, I completed a PhD in electrical engineering and management at MIT and my thesis won first prize in the 1994 PDMA International Dissertation Competition. In January 1994, I started at McKinsey in Cologne, Germany."

Michael Owen, SM '63, is the dean of the College of Business at Montana State University. . . . From Old Greenwich, Conn., **Michael deMarco**, SM '68, writes: "I am continuing to develop new asset-allocation strategies for global-equity exposure management using the dreaded derivatives." . . . **Dominic D.J. Endicott**, SM '93, writes: "I'm working at Monitor in Cambridge (five minutes from MIT) and traveling regularly to Europe and South America." . . . Another local alumnus, **Curt P. Kohlberg**, SM '82, reports: "My wife, Allegra, and I are proud to announce that our daughter, Sara, is now one year old and doing well. My company, Kohlberg & Associates, is now

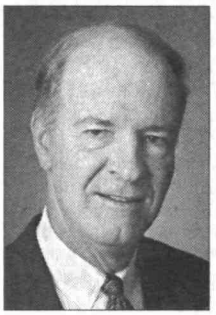
in its fifth year and is moving to Weston, Mass., in early 1995." . . . **Alexander H. Mack**, SM '94, sends word: "I am spending my time either working or taking care of my daughter, Rebecca Ayala Mack." . . . **Richard Moore**, SM '92, and **Carol L. Smith**, SM '92, are engaged. The wedding is planned for October 1995 at Disney World in Florida. They write, "If you're in the neighborhood, stop by." Richard and Carol work for Monsanto Co. in St. Louis, Mo.

John James Kinley, SM '50, announces: "I was appointed in June 1994 as lieutenant governor of the Province of Nova Scotia. I am the first professional engineer registered in the province to have ever done so. My wife, Grace, and I were fortunate in the first year of our term of office to have a visit from Her Majesty the Queen and HRH the Duke of Edinburgh." . . . **Douglas F. Ward**, SM '66, is the director of corporate reporting for the Dow Chemical Co. . . . **Joel S. Pratt, Sr.**, SM '66, writes: "I retired on March 1, 1994. I'm building a new home on the coast near Machias, Maine." . . . **Michael Treacy**, PhD '84, former professor of management science at Sloan, has co-written *The Discipline of Market Leaders: Choose Your Customers, Narrow Your Focus, Dominate Your Market* with Fred Wiersema, a senior VP of SCS Index.

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SLOAN FELLOWS

Jere **A. Drummond**, SM '79, has been promoted to president and CEO of BellSouth Telecommunications (BST). BST serves more than 20 million telecommunication lines in its nine-state regions, has 79,000 employees, and generated more than $13.5 billion in operating revenues in 1993. Among his many civic and community activities, Drummond is a director of the Georgia State University Alumni Association, a trustee of the Georgia State University Foundation and Shorter College, and a member of the Georgia Tech National Advisory Board. He is a director of the Science and Technology Museum in Atlanta, the Institute for Educational Leadership, Inc., in Washington, D.C., and the SouthEastern Regional Vision for Education. Drummond and his wife, Patsy, have three children.



Jere Drummond

The Association of Alumni and Alumnae has been notified of the death of **Charles Ray Marcum**, SM '79, on September 15, 1994. No further details were provided.

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SENIOR EXECUTIVES

David M. Hall, '76, writes: "I retired from EDS as a regional manager in August 1993. I am currently an assistant professor of business at Northwood University in Midland, Mich."

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CourseNews

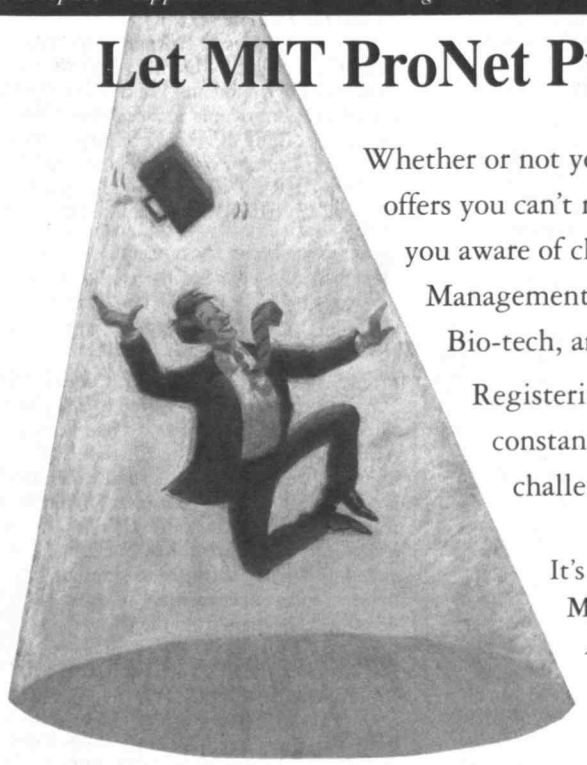
MANAGEMENT OF TECHNOLOGY

Akio Mitsufuji, SM '89, wrote to tell us that **Alexander Clelland**, SM '89, and his family visited him in Tokyo in April 1994. Akio arranged a reunion dinner with Clelland and the Japanese MOTs in Akasaka, Tokyo. **Meir Zucker**, SM '89, was also in Japan on business in November 1994 and visited with the Japanese MOTs in Aoyama, Tokyo. . . . **Tom Lydon**, SM '90, was promoted to department manager at Raytheon Co. and manages more than 100 software engineers. . . . **Barbara Proud**, SM '90, reports that she has been traveling a great deal, and recently purchased a house in Perth, Australia, with her daughter, Virginia. Her son, Trevor, graduated from Berkeley College and is "seeking fame and fortune" in Seattle. . . . **Hiroyuki Ogawa**, SM '91, started a new position as staff assistant manager at the Kawaski Steel Corp. in April 1994. . . . **Toshihiko Shoyama**, SM '92, is working in the international planning division at Mitsubishi Bank, Ltd., in Tokyo. In this position, he is responsible for establishing a representative office for the Mitsubishi Bank in Vietnam.

Singo Fukuda, SM '92, recently started working as senior assistant manager in the engineering department of AT&T Yazaki Fiber Optic Cable Co., Ltd. This new company is a joint venture between AT&T and Yazaki and manufactures and sells fiber-optic

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cable and accessories. Fukuda is the technical interface between AT&T and the company. . . . **Andries Botha**, SM '92, has started his own company, Dynamic Strategy Modelling CC., in Wingate Park, South Africa. . . . **Armando Izquierdo**, SM '83 (II), SM '92, told us he has been working for PDVSA this past year, in strategic planning. He will hold that position for a few more months and will then return to planning at Intevep. Izquierdo reports that his family is well. His wife became a "regular staff" member at USB University in September 1994. . . . **Barney Ussher**, SM '92, wrote to tell us that his major project in 1994 was a consulting assignment to provide bench marking in technology policy to the Chinese Ministry of Electronics under the auspices of the World Bank. Ussher has also been scouting opportunities related to the Internet, including the possibility of broadening the reach of the weekly Internet newsletter by Liam Ferrie. Ussher and a group of MOTs meet frequently "over the Internet" and in person for pizza at Bertucci's in Cambridge, Mass. He invites MOT alumni/ae to join their group anytime.

Lyle Hart, SM '92, sent us photographs of the wedding of classmate **Bruce Dewar**, SM '92, to Barb McClean. The wedding, held in Vancouver, B.C., in August 1994, provided a great opportunity for an informal MOT reunion and was attended by **Soo Sheung Wong**, SM '91, **Joseph Fitzgerald**, SM '92, **David Isenhour**, SM '92, **Solomon Israel**, SM '92, and **Jonathan Otterstatter**, SM '92. Lyle also reports that he still works for IBM in Raleigh, N.C., where IBM has consolidated much of their PC business. He attended a conference in Washington in the fall of 1994, to discuss the future of the information highway with key industry and government leaders. David Isenhour is working in the power personal systems division at IBM in Austin, Tex. He manages a team responsible for the overall strategic planning and competitive analysis of the company's RISC System/6000 clients and soon-to-be-announced PowerPC-based clients in the personal computer market space. . . . **Gary Hight**, SM '92, returned to Atlanta and changed his position at BellSouth. He is now responsible for overall regulatory policy for all the BellSouth wireless companies (cellular, paging, mobile data, and PCs) and a software development group at BellSouth. . . . **Usman Ghani**, SM '91 (XV, TPP), SM '92, was inducted into the *Who's Who Worldwide* registry and became a life member of its executive club. He also wrote an article on successful reengineering that will be published in AMA's *Management Review* in 1995.

Via e-mail, **Masahiko Tsuchiya**, SM '93, expressed his excitement in joining the MOT net and would like to invite his classmates to contact him through the WWW by accessing the "Toyo Engineering Corporation."

Makoto Ishizuka, SM '93, has a new position as senior researcher at Panasonic Technologies, Inc., in Cambridge, Mass. . . . **Amal Alayan**, SM '93, is working as a management consultant with a London-based company, KPMG Peat Marwick, in Jerusalem. . . . **Josh Lindsay**, '80 (II), SM '93, reported via the "MOT e-mail net that his family is fine, including daughter Aria who was born in June 1994. . . . **Richard Bailey**, SM '93, wrote via e-mail about the state of affairs in South Africa since the election of President Nelson Mandela. Bailey notes that new vistas in business have opened and South Africa is very positive about its future.

Jonathan Green, '77 (VIII), SM '93, wrote to tell us that his company, High Point Systems, Inc., is rapidly growing in the home shopping market. Jonathan and his wife, Jennifer, celebrated the first birthday of Elise and Eric, who were born in December 1993.

Sigmund Kvernes, SM '93, and Anne Rigmor Loefors visited Singapore in September, and happily report this news: **Choon Kwang Tan**, SM '93, has married Ms. Li Ping, a graduate student born in China. Sigmond and Anne stayed with the Tans for one week, and were delighted to catch up with **Francis Yeoh**, SM '93 and his wife, Karol; **Tok How Lim**, SM '93, and his wife, Jenny; **Christopher Firth**, SM '93, and Monique; and **Wan Pok Steven Wu**, SM '93. Sigmond and Anne also joined the MIT Club of Singapore for dinner, which included a presentation by Professor **Ed Roberts**, '58 (VI), SM '58 (VI), SM '60 (XV), PhD '62 (XIV), on new activities at Sloan. After Singapore, the Kvernes went to Tokyo, where they visited with their Japanese classmates.

Yoshio Noda, SM '94 returned to Yazaki Corp. in the comprehensive planning division. He wrote to tell us that the Japanese MOT alumni/ae met in October 1994 to wish **Makoto Ishizuka**, SM '93, luck in his new position at Panasonic Technologies, Inc., in Cambridge, Mass.

Augustin Silva, SM '94, is the production manager at UNEMSA in Spain. . . . **Hideki Okajima**, SM '94, returned to Yoshitomi Pharmaceutical Industries, Ltd., as manager of planning and coordination of the R&D division.

Toshiharu Aoki, SM '94, is in the planning division of Asahi Chemical Construction Materials Co., Ltd. He is involved in the internationalization of the business, specifically in Asia.

Vicente Sanchez, SM '94, wrote to tell us of his new position at Intevep S.A. as manager in the analysis and evaluation department.

Send news via e-mail to <mitmot@sloan.mit.edu> or write to Management of Technology Program, MIT, 50 Memorial Dr., Suite E52-126, Cambridge, MA 02142.

XVI AERONAUTICS AND ASTRONAUTICS

Hew Phillips, '39, SM '40, received the U.S. President's Award for Distinguished Federal Civilian Service at NASA for directing simulation and analytical studies on the Gemini, Apollo, and Shuttle programs. Also, he is member of the Model Aviation Hall of Fame. He built many model airplanes and gliders to participate in contests and meets. The Virginia Air and Space Museum has his model wind tunnel on display. Phillips is building a strain gauge balance to demonstrate how drag is studied and air flows over airplane surfaces are optimized. "I'm still working for Boeing in Huntsville, Ala.," writes **Ronnie Lajoie**, SM '87. "I'm currently dividing my time between the space-station program and the new reusable-launch-vehicle program. I'm also working with my local space club to build a rocket and launch it from a balloon at over 100,000 feet. The amateur space race has begun!"

Edwin N. Myers, SM '61, is an adjunct research staff member at the Institute for Defense Analyses in Alexandria, Va.

From Dedham, Mass., **Peter J. Palmer**, '50 (VI), SM '70, writes: "Jeanne and I now have five grandchildren (three girls and two boys). Our most recent trip was to Switzerland with the MIT Alumni/ae Campus Abroad. It was very enjoyable and we learned more about the country than others who have been there several times! I am continuing my consulting activities in inertial guidance and navigation technology. . . . Navy Ensign **Joseph E. Dennis**, '92, SM '93, recently graduated from the submarine officer basic course at the Naval Submarine School in Groton, Conn. He joined the Navy in May 1993. During the 12-week course, students learn about the theory, construction, and operation of nuclear-powered submarines. They also receive instruction concerning damage control, submarine safety, and escape procedures.

The Association of Alumni and Alumnae has learned that retired Captain **Creighton W. Cook**, SM '54, USN, of Big Bear Lake, Calif., died on August 12, 1994. No further information was available.

lumni/ae may send information for Course News to **<mitalum@mitvmc.mit.edu>**.

XVII POLITICAL SCIENCE

From Canberra, Australia, **Peter Quiddington**, SM '92, writes: "Now I operate a desktop-publishing and consulting business, Science Media, with a prime focus of science and technology policy in the Asia-Pacific. I am also a regular contributor to the Australian Financial Review on science policy. I can be contacted by e-mail at <73730.3613@compuserve.com>." . . . **Archelaus Rye Turrentine**, SM '74, is working on demilitarization programs in Russia and the Ukraine.

Via e-mail, **Marc E. Norman**, SM '89, writes: "I received a PhD in Energy Management and Environmental Policy from the University of Pennsylvania in December 1994. I am now working as an environmental policy research consultant in Washington, D.C."

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XVIII MATHEMATICS

From Bellevue, Wash., **Allan J. Cooper**, SM '75, PhD '75, writes: "I moved to Microsoft three years ago. Prior to that I had been at Los Alamos National Labs, an LA-based PC importer, and had my own small company, Digital Word Corp. The idea at Digital Word was to do assisted test retrieval similar to what Verity and others are doing, but instead, we ended up writing software to simulate DNA hybridization experiments. I've often wondered where others from the math PhD program ended up. **David Vojan**, PhD '76, and **Hal Abelson**, PhD '73, are professors at MIT. **Jayant Shah**, SM '59 (I), ScD '61 (I), PhD '74 is working with Mumford at Harvard on computer pattern recognition stuff. **Andy Odlyzko**, PhD '75, and **Jeff Lagarias**, '72, SM '72, PhD '74, are at Bell Labs. We should set up an Internet mailing list or reunion!"

News from **Joseph J. Buff**, SM '77: "I am a principal in the New York City office of Till-

inghast, a Towers Perrin company. I have been there for eight years and am the firm's national practice leader for asset/liability management. We are a worldwide actuarial consulting firm. Over the years, I have been a leading expert on technical and management consulting to insurance companies about risk management and investment operations. I have been a principal for four years now. My training in math and in research by Professor **Dan Kan** was invaluable to my later works. I try to stop by the MIT campus whenever I visit clients in Boston."

Robert H. Scanlan, PhD '43, writes: "My colleagues and graduate students honored me at a symposium at John Hopkins University on October 28–29, 1994 on the occasion of my 80th birthday."

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XX APPLIED BIOLOGICAL SCIENCES

Joan Marie Conway, PhD '79, is working at the USDA Diet and Human Performance Lab in Beltsville, Md. She can be reached via e-mail at <jconway@asrr.arsusda.gov>. . . . **Sheila Collins,** PhD '85, is a professor at the Duke University Medical Center. Activities include academic research, travel, and collaboration with researchers in Switzerland and the United Kingdom.

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XXI HUMANITIES

Via e-mail, **Ron Logan,** '90, writes: "Yes, I actually have a degree from MIT in literature! It's kind of depressing that I never see any Course XXI News in *Technology Review*—let alone Course XXI-L—so I thought I'd send a little note about what I'm doing nowadays in the hopes of actually having something to read about next time. I am now working as a software design engineer in test for Microsoft in Redmond, Wash., where I develop test applications for the Visual C++ project. I still keep a copy of my favorite novel, *Moby Dick*, on the bookshelf in my office. I've been happily married now for almost three years. My wife, Julie, and I have two huge beautiful cats named Fred and Abbey. No kids yet. We're going to Alumni/ae Week this year so I can show Julie all around Boston and MIT. I can't wait! My e-mail address is <ronlo@microsoft.com>."

Alumni/ae may send information for Course News to **<mitalum@mitvmc.mit.edu>.**

XXII NUCLEAR ENGINEERING

Richard E. Donovan, SM '68, was named president and CEO of ABB, Inc., in 1994. He is also executive VP of ABB Asea Brown Boveri Ltd., Zurich, and oversees the operations of the Americas. Donovan was the president of ABB Power Plant Systems, ABB's U.S. boiler and turbine operations. He joined ABB in 1992 after two years at Foster Wheller as VP and group executive of its Energy Equipment Groups, with responsibility for companies in the United States, Canada, and Spain. Before that he spent 17 years at Babcock and Wilcox in domestic and international general management assignments. Donovan is an alumnus of the U.S. Military Academy at West Point and spent 10 years in the U.S. Army Corps of Engineers, with assignments in the United States, Thailand, and Vietnam. . . . Also at ABB, **Richard A. Loretz,** SM '80, writes that he is supervisor of the Nuclear Programming Group, ABB Combustion Engineering Nuclear Operations. . . **Andrew J. Wolford,** ScD '87, sends word from Katy, Tex.: "I have returned from a two-year assignment in Aberdeen, Scotland, and continue my activities in risk/safety analysis in the oil/gas/petrochemical/nuclear industries with Det Norske Veritas."

Domingo Giorsetti, SM '77, writes: "I'm the director of the Organizational Learning Center of Argentina, which operates out of the Buenos Aires Institute of Technology. The OLC is a consortium of the eight biggest companies in Argentina. We are working with researchers from MIT's OLC." . . . **William R. Corcoran,** PhD '71, reports: "I am still doing corporate-level nuclear safety oversight and review work as president of Nuclear Safety Review Concepts Corp. in Windsor, Conn. I serve as a member of safety and management oversight committees for Palisades, Big Rock Point, Maine Yankee, Millstone, Connecticut Yankee, Calvert Cliffs, St. Lucie, and Turkey Point Nuclear Stations. In 1994, I assisted utilities in organizational learning from adverse events at Zion, Millstone, Palisades, and Turkey Point. My other specialties are utility self-assessment and operational safety, which have been subjects of my lectures for MIT Nuclear Reactor Safety summer courses."

Alumni/ae may send information for Course News to **<mitalum@mitvmc.mit.edu>.**

XXIV LINGUISTICS AND PHILOSOPHY

Wha-Chun Mary Kim, PhD '76, writes: "I am currently supervising and managing the Japanese and Korean language programs at the Foreign Service Institute, National Foreign Affairs Training Center in the U.S. Department of State."

Alumni/ae may send information for Course News to **<mitalum@mitvmc.mit.edu>.**

TPP TECHNOLOGY AND POLICY PROGRAM

Richard Davies, SM '84, and Josie Stein are pleased to announce the arrival on November 10, 1994, of Graham Douglas Stein Davies. Best wishes to all three. . . . **Steve Pinkerton,** SM '85, is responsible for demand supply management at HEC, Inc. Steve is currently working on several projects at Harvard University. . . . **Usman Ghani,** SM '91 (XV,TPP), SM '92 (XV), was inducted into the *Who's Who Worldwide* registry and has become a life member of its executive club. He recently submitted an article to AMA's *Management Review* on making reengineering successful (to be published in 1995). Usman was able to take time out of his busy schedule in 1994 to travel, attend performing art concerts and visit local museums. He informed TPP that he also managed to attend two excellent Indian classical music programs.

Rumor has reached TPP that Karijn and **Jan Van Acker,** SM '91, SM '92 (XV), are expecting their first child in April 1995. Congratulations! . . . **Jane Song,** '91 (III), SM '93 (III, TPP), and **Paul Whitworth,** SM '93, have announced their engagement. Best wishes to the two of you and don't forget to send us pictures. . . . **Paulo Bellotti,** SM '94, had a great time with **Jeff Goldman,** SM '94, who visited during his South American trip. Other TPPers and friends are invited to call Paulo when in Brazil. . . . **Michel Grillot,** SM '80 (I), a TPP Friend, executes petroleum development. . . . **Yoshihiro Ichikawa,** SM '68 (I), another TPP Friend, is the director general of Tokyo Construction Bureau at Toranomon.—Richard de Neufville, TPP chairman and professor of civil and environmental engineering, MIT, Room E40-252, Cambridge, MA 02139

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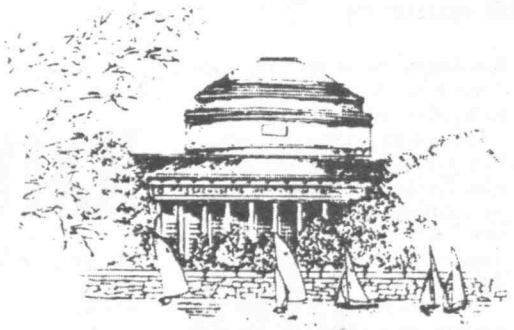
Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

George R. Lord, '10; January 12, 1978; Largo, Fla.
Ming H. Pai, '20; April 4, 1992; Woodbury, N.Y.
James B. Spratley, SM '22; December 3, 1994; Richmond, Va.
John B. Lewis, '24; December 17, 1994; Hightstown, N.J.
Raymond Paul Schreiber, Sr., '24; December 3, 1994; Sun City Center, Fla.
Clifford O. Abrahamson, '25; February 18, 1994; West Palm Beach Fla.
Charles L. Norton, Jr., '25; June 3, 1993; Augusta, Ga.
Thomas A. Esling, '26; August 23, 1992; St. Petersburg, Fla.
Marian R. Fielding, '26; December 24, 1994; Marblehead, Mass.
Walter Sargent Graves, '26; May 13, 1994; Richland, Wash.
John K. Sumner, '26, PhD '34; January 15, 1995; Somers, Conn.
Ralph E. Boeck, SM '28; November 22, 1994; Wauwatosa, Wis.
Clifford P. Kittredge, '29; February 2, 1995; San Jose, Calif.
Joaquin J. Llanso, '29; November 30, 1994; The Woodlands, Tex.
John W. Flatley, '32; November 12, 1994; Chevy Chase, Md.
Charles H. Fischer, '32; May 4, 1994; Chicago, Ill.
Joseph C. Noyes, Jr., '32; November 16, 1993
Louis C. Raymond, SM '32; October 19, 1994; Chappaqua, N.Y.
Edmund B. Norman, Sr., '33; December 23, 1994; Richmond, Va.
LeBurton D. Webster, '33; January 26, 1995; Concord, Mass.
George M. Cunha, '34; November 30, 1994; Lexington, Ky.
Henry Mazer, '34, SM '35; July 10, 1994; Beer Sheva, Israel
Hereward A. Reynolds, '34; June 28, 1994; Needham, Mass.
Bernard N. Stiller, '34; December 26, 1994; Tucson, Ariz.
Malcolm G. Cameron, '35; July 1982; Irvington, Va.
Harold A. Brown, '36; November 2, 1994; Hampton, N.H.
Douglass Hawks, Jr., '36; December 25, 1994; Apple Valley, Calif.
Stanley Levitt, '36; March 12, 1994; Midland, Tex.
Henry C. Mabie, '36; July 31, 1994; Concord, N.H.
VanBuren N. Hansford, '37; March 10, 1994; Marco Island, Fla.
Milton Karr, '37; November 29, 1994; Pittsburgh, Pa.
William V.L. Binder, '38; December 1990; Savannah, Ga.
Henry P. Rumble, SM '38; January 25, 1995; Ventura, Calif.
Theodore J. Gundlach, Jr., '40; May 10, 1994; Venice, Fla.
John H. Halford, Jr., SM '40; March 6, 1994; Center Lovell, Maine
Carl L. Goodwin, '41; November 28, 1994; Wilsonville, Ore.
Stuart B. Dunham, '42; January 16, 1995; Schenectady, N.Y.
William D. Bowman, '44; January 15, 1995; Detroit, Mich.
Andrew F. Corry, '44; December 22, 1994; W. Hyannisport, Mass.
Risto T. Hukki, ScD '44; December 27, 1988; Espoo, Finland
Melvin L. Milligan, '44; November 28, 1994; Greenwich, Conn.
Melvin B. Zisfein, '46, SM '48; December 23, 1994; Augusta, Ga.
Nils M. Bengtson, SM '48; January 20, 1995; East Falmouth, Mass.
Arthur Benjamin Clymer, SM '48; July 20, 1994; Hessel, Mich.
Irving Gray, PhD '48; December 17, 1994; Bethesda, Md.
Otis C. Ferrell, Jr., SM '53; September 19, 1994; San Juan Batista, Calif.
Paul M. Quay, '55, PhD '58; October 10, 1994; Chicago, Ill.
Mary Ann C. Shukaitis, '56; March 1989; Teaneck, N.J.
Jacques Naar, SM '58, CE '58; May 25, 1994; Palo Alto, Calif.
Alan Lee Titchener, ScD '58; June 23, 1994; Auckland, New Zealand
William H. Glenn, Jr., '59, SM '60, PhD '66; January 15, 1995; Vernon, Conn.
Steven W. Maxwell, '75; 1972
Jeffrey G. Nanis, '85; January 26, 1995; Cambridge, Mass.
Zhong Cai, SM '86, ScD '90; January 1, 1995; Atlanta, Ga.



WHERE MIGHT
A NAME BEST LIVE?



The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues and family. Memorial gifts can be unrestricted or directed toward scholarships, research or any program of the Institute. The Institute notifies bereaved families of the name of each donor, and each gift becomes a part of MIT's permanent record.

Named endowed funds whose income supports the work of the Institute in perpetuity can be established with larger gifts. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617) 253-8059.

PuzzleCorner

Today is Thursday, and this Saturday will be a big day for our family: my older son, David, has his Bar Mitzvah. He seems pretty calm about it, and certainly his performance at the run-through on Tuesday inspires confidence. We shall see. I still remember well the night he was born; it is hard to believe that was almost 13 years ago. Anyway, congratulations David, in advance, on a job well done.

It is now Monday, and the congratulations were earned. I think the parents did OK as well. Indeed, David told us after the reception that the musicians we picked over his desire for a DJ playing rap music (a true oxymoron) "were not as bad as I expected," the highest compliment we could hope for. Moreover, last night before going to bed, he thanked Alice and me for giving him a wonderful Bar Mitzvah. Moments like those make up for a lot of the annoyances that accompany child-rearing (at least our child-rearing), and have put the family into a positive mood for the (shudder) teenage years ahead.

Problems

M/J 1. We begin with a bridge problem from Jorgen Harmes who wants you to make six spades when West leads the 10 of clubs.

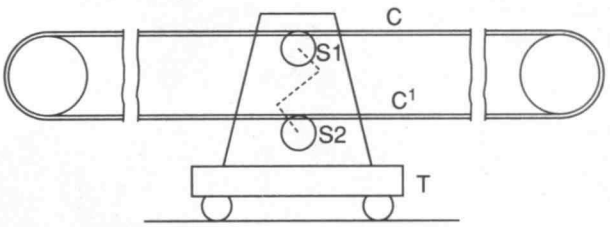
	North	
	♠ A K Q J	
	♥ K J 8 6 5 3 2	
	♦ 7	
	♣ Q	
West		East
♠ 6 3		♠ 4
♥		♥ A Q 10 9 7 4
♦ K Q J 9 5		♦ 8 3
♣ 10 9 7 4 3 2		♣ J 8 6 5
	South	
	♠ 10 9 8 7 5 2	
	♥	
	♦ A 10 6 4 2	
	♣ A K	



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OR TO: GOTTLIEB@NYU.EDU

M/J 2. James Abbott likes to play with trains, gear trains that is, and offers us the following challenge.

A traveling carriage T is connected to an endless chain CC[1], which engages identical sprockets S1 and S2. The sprockets are connected to each other by a gear train whose ratio is defined by the number of revolutions of S2 for one revolution of S1. The sign of this ratio is considered positive when S1 and S2 rotate in the same direction.



By suitably altering the gear train, a variety of motions can be imparted to the carriage.

Letting C refer to the *upper* run of the chain, determine the gear ratio (magnitude and sign) for the following six conditions:

1. T moves in the same direction as C, at half the speed of C.
2. Same, but at twice the speed of C.
3. T moves in a direction opposite to that of C, at half the speed of C.
4. Same but at twice the speed of C.
5. T remains motionless regardless of the speed of C.
6. T can be moved freely in either direction (by separate forces) but the chain cannot be budged.

M/J 3. How's your geometry? Gordon Rice asks how many primitive Pythagorean triangles are there whose inscribed circle has diameter 1992. Recall that 6, 8, 10 is not a primitive Pythagorean triangle since it is simply a multiple of 3, 4, 5.

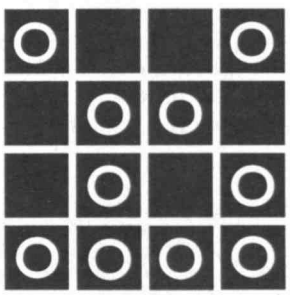
Speed Department

Tim Shepard wonders approximately how many iterations will the following C program execute (for concreteness, assume IEEE standard arithmetic).

```
int main ( int argc, char *argv[] ) {
  double i = 0.0 , sum = 0.0 ;
  do {
    i = i + 1.0 ;
    sum = sum + 1.0 / i ;
  } while ( sum < 100.0 ) ;
}
```

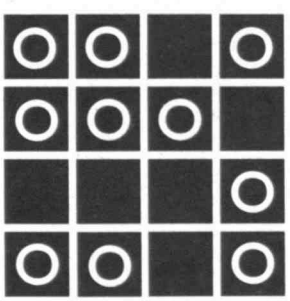
Solutions

Jan 1.



In the figure above the 10 circles are placed so that there are 10 rows, columns, and diagonals that each contain an even number (2 or 4) of circles. In 1928 Sam Loyd asked how to place the 10 circles so as to obtain the maximum number of rows, columns, and diagonals containing an even number of circles. Nob Yoshigahara, in the spirit of today's "less is more" generation, asks you to place the 10 circles so as to obtain the minimum number of rows, columns, and diagonals containing an even number of circles.

Several readers found a solution with zero such rows, columns, and *main* diagonals. Perhaps the problem should have been clearer: we want to consider all diagonals, not just the two with four entries. However, all the solutions received that solved the problem as intended, did have zero odd rows, columns, and main diagonals, so in fact these solutions solve both interpretations of the problem. The following solution, from Gardner Perry, contains one odd (non-main) diagonal. A computer search by Donald Savage has determined that this solution is the best possible.



Continued on Page MIT 40

MIT LIFE INCOME FUNDS

MR. AND MRS. MORRIS E. NICHOLSON

HOME: Falcon Heights, Minnesota

CAREER: Professor Morrie Nicholson entered MIT's graduate program in physical metallurgy in 1939, just after completing his undergraduate degree. But in 1941, with a reserve commission in the Army Ordinance Department, he volunteered for active duty. He returned to MIT five years later and completed his Sc.D. in 1947. After working for three years with Standard Oil of Indiana, he joined the Institute for the Study of Metals at the University of Chicago in 1950, and in 1956 the University of Minnesota Department of Metallurgy. He retired in 1985.

Morrie and his wife Norma have served as community and professional volunteers for most of their married lives. Active with the MIT Club of Minnesota, Morrie helped raise funds for his class's 50th reunion, and with classmates established the Class of 1939 Metallurgy Fellowship. He and Norma are Life Sustaining Fellows and members of the Katharine Dexter McCormick '04 Society. They have three sons, nine grandchildren and four great grandchildren.

MIT LIFE INCOME FUND:
The Morris E. and Norma S. Nicholson Fund.

QUOTE: My undergraduate days at MIT were very special. The fraternity system gave us the opportunity to meet many students and adults and to become adults ourselves. The faculty was friendly and encouraging — Vannevar Bush, for example, vice president of MIT at the time, taught our freshman English class the essential points of a patent for the Stillson wrench. Our MIT Life Income Fund not only provides us with income now, but will ultimately help others have the same great experience I had.

For more information about MIT Life Income Funds, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, 77 Massachusetts Avenue, Room 4-234, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

Photo: Steve Kjelland and Associates, St. Paul, Minnesota



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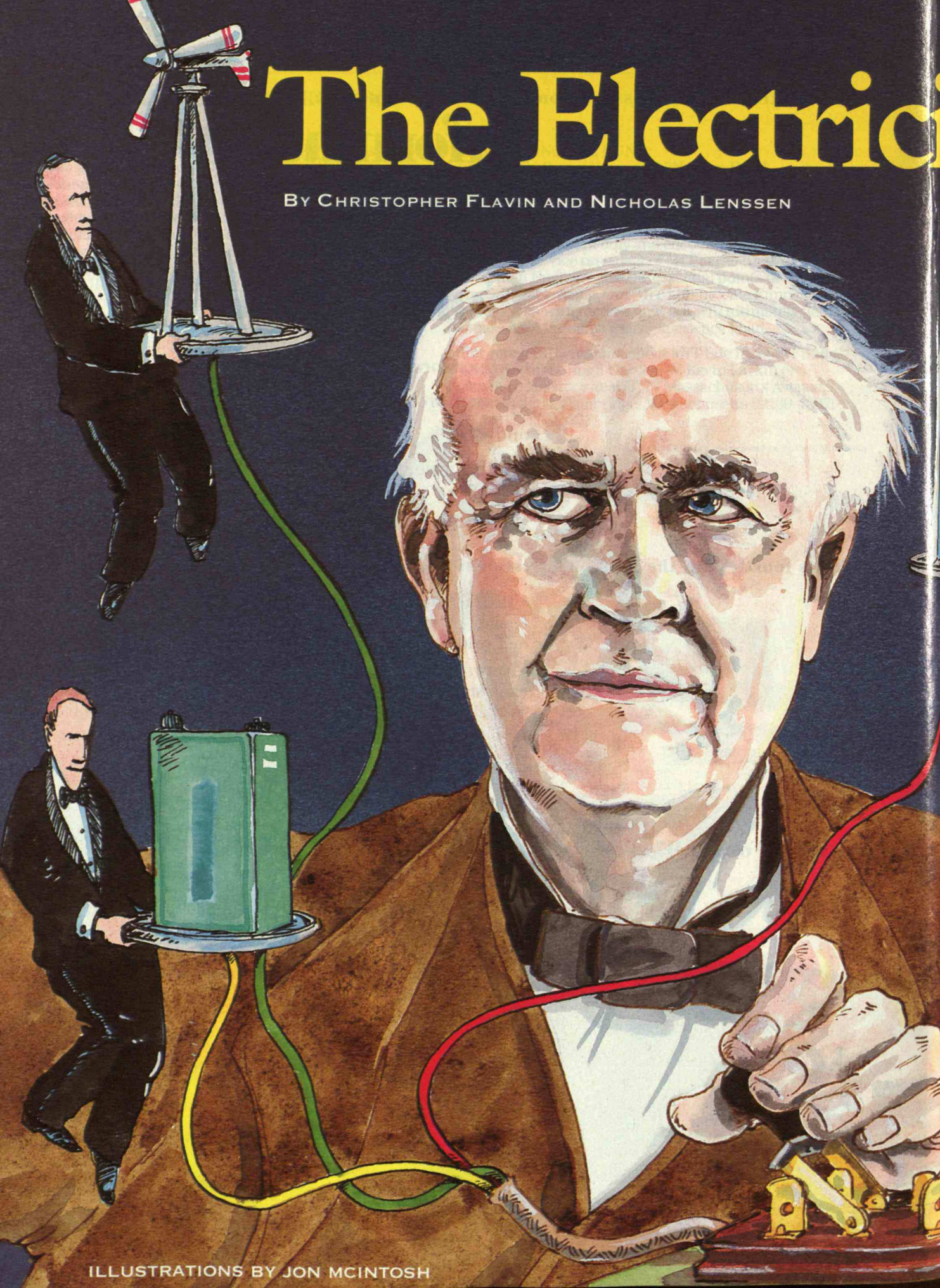
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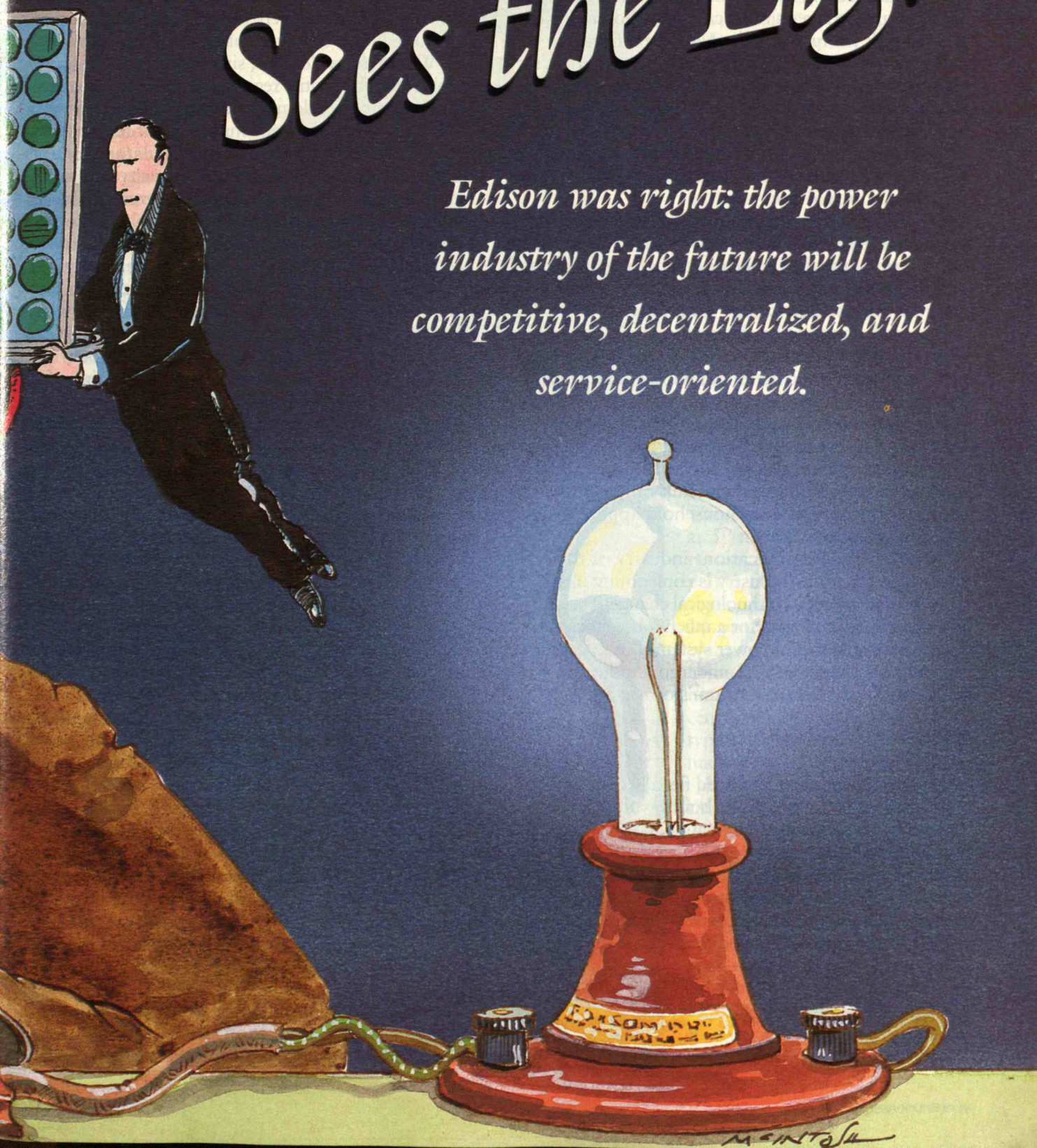
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The Electric
By Christopher Flavin and Nicholas Lenssen
Illustrations by Jon McIntosh

y Industry Sees the Light

Edison was right: the power industry of the future will be competitive, decentralized, and service-oriented.



THOMAS Edison started the world's first electric power company in New York City in 1880. In a Wall Street warehouse, he connected a coal-fired boiler to a steam engine and dynamo, then linked the plant by underground wire to a block of nearby office buildings. When he flipped the switch, 158 light bulbs (also designed by Edison) flashed on, and the Edison Electric Illuminating Co. made converts of its carefully chosen first customers—J.P. Morgan and the *New York Times*.

Edison envisioned electricity as a competitive, service-oriented business with numerous suppliers. He would hardly recognize the vast monopolies that dominate the U.S. power industry today. Yet that very industry—long known for its fierce resistance to change—is now poised for a transformation that may bring it closer to Edison's original vision.

The winds of competition are roiling the power business. Since the early 1980s, a new breed of independent power companies has emerged to challenge protected utilities by building cleaner, more innovative, and more efficient plants. The Energy Policy Act of 1992 has heightened competition by giving these companies access to new markets. At the same time, miniaturized generators such as fuel cells and photovoltaics promise to transform the economies of scale that have shaped the industry, opening up a new era of decentralized power generation—perhaps even allowing individual homeowners to generate their own power. And new telecommunications technologies may link millions of these small generators and even household appliances into one "smart" power system.

Like the telecommunications industry of the early 1980s, the electricity industry is confronting increased competition and rapid technological change. These pressures could pave the way for a much more efficient and environmentally sound power system. But to get there, electric utilities will have to undergo a radical restructuring much like the one that transformed Ma Bell.

Roots of Monopoly

The electricity industry remained fiercely competitive in the two decades after Edison built his first generator. Unfettered by government regulation, power companies proliferated, often running competing electric lines down opposite sides of the same street. At the turn of the century, four dozen power companies served Chicago alone, and many businesses generated their own electricity. Some experts believed that the power industry would remain relatively decentralized, relying in part on stand-alone, mass-produced generators.

Technological change, however, paved the way for a more centralized industry. Larger and more efficient steam turbines and generators made it cheaper to produce power at large plants than at small ones. The introduction of alternating current and the transformer made it possible to raise the voltage of electric current so that it could be transmitted across much longer distances and then to reduce it to lower voltages, safe for household use. Within a few decades, single utilities were serving whole cities, then entire regions. Soon a number of giant holding companies dominated the power industry.

With monopoly came an implied public responsibility. In 1907, states began to establish regulatory commissions to determine fair prices for electricity and to provide financial stability for utilities; Congress established the Federal Power Commission to regulate interstate power sales. Since then, the U.S. power industry has been organized mainly as a group of vertically integrated, privately owned monopolies. Although some communities are served by municipal utilities, which often distribute electricity purchased from outside generators, most utilities generate power at their own plants, transmit it across their own power lines, and distribute it to their own customers in local communities. (Many of these utilities also buy and sell excess electricity among themselves.)

For several decades, the size and efficiency of power plants grew and the price of electricity fell. Between 1950 and 1973, U.S. electricity use grew fourfold as refrigeration, air conditioning, and other amenities became common. But then the fairy tale came to an end: fuel prices soared, the cost of new power plants (particularly nuclear ones) skyrocketed, and the growth in electricity demand fell from nearly 8 percent per year to less than 3 percent. Utilities began to press for frequent rate increases, fueling a consumer backlash and spurring challenges from state regulatory commissions.

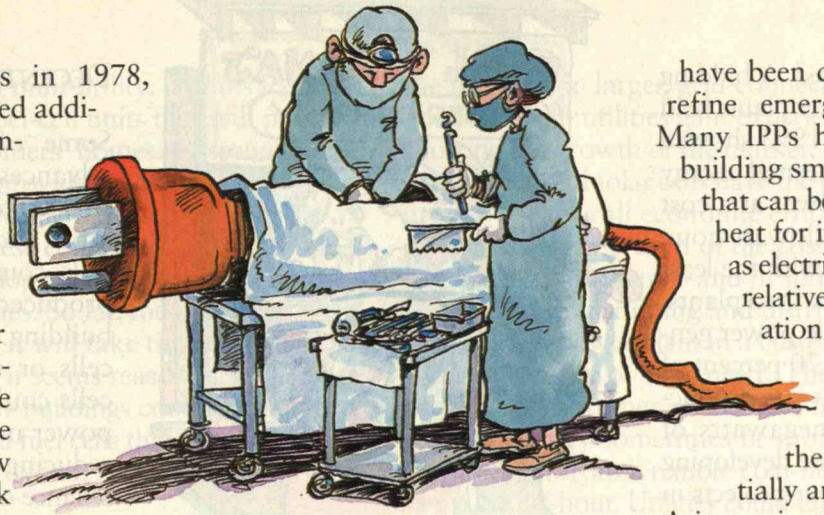
By the late 1980s, utility companies had abandoned scores of partially completed nuclear stations; some firms were on the verge of bankruptcy. After environmentalists raised concerns about the huge flow of pollution from large generating plants, the federal Clean Air Act forced utilities to invest in a series of expensive pollution-control devices. The combination of high rates and poor environmental performance made electric utilities unpopular in many regions, and calls for their reform blossomed.

The New Power Brokers

The first step in rejuvenating the electricity industry was to open the power-generation side to limited competition. The Public Utility Regulatory Policies Act, passed

CHRISTOPHER FLAVIN is vice-president for research and NICHOLAS LENSSEN is a senior researcher at the Worldwatch Institute, a public-policy group based in Washington, D.C. They are coauthors of Power Surge: Guide to the Coming Energy Revolution *(W.W. Norton, 1994.)*

by the U.S. Congress in 1978, directed utilities that need additional electricity to compare the cost of building the capacity they need with the cost of purchasing it from independent companies using cogeneration or renewable-energy technologies, and to choose whichever power source is less expensive. The law was intended to break the utilities' monopoly over power generation and at the same time encourage investment in new energy technologies. Many utilities fought this groundbreaking legislation bitterly, first in Congress and then in the courts, delaying its implementation until the mid-1980s, when it was narrowly upheld by the U.S. Supreme Court.



Although few states aggressively enforced the law, the independent power industry has grown steadily, particularly in more receptive areas such as the West Coast, Texas, and the Northeast. Independent power producers (IPPs) produced 58,000 megawatts of electricity in 1993, accounting for 7 percent of the nation's power; in the early 1990s, independents added about the same amount of new capacity as did traditional utility companies.

Independent power businesses range from small start-ups to major corporations like Texaco and, more recently, utility subsidiaries like PG&E Enterprises. Contrary to the early forecasts of many industry executives, IPPs have shown that they can produce electricity at prices that are often lower than those of established utilities and that competition can advance technological innovation, efficiency, and environmental quality in the power industry as a whole.

Electric utilities will have to undergo a radical restructuring much like the one that began transforming Ma Bell a decade ago.

Independent power companies have been quick to adopt and refine emerging technologies. Many IPPs have specialized in building small-scale generators that can be used to cogenerate heat for industrial use as well as electricity. One promising, relatively small-scale generation technology that was quickly taken up by the independent power industry is the gas turbine—essentially an adapted jet engine. A jet engine burns a pressurized mixture of air and fuel, usually natural gas, to spin a turbine, which generates the thrust that moves the jet forward. In power generation, the turbine is used to generate electricity, while excess heat from the turbine powers a steam turbine, boosting efficiency.

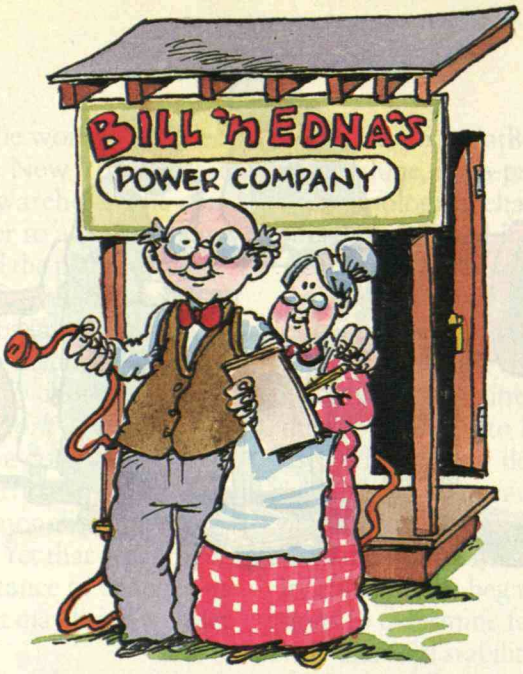
Gas turbines are as much as 50 percent efficient, compared with the 33 percent efficiency typical of the steam-cycle plants that provide most U.S. power today, and emit far less pollution than the previous generation of fossil-fueled plants. They can be built at scales as small as 50 to 100 megawatts (5 to 10 percent the size of a large nuclear plant), can be completed in two years or less (compared with 5 to 10 years for coal and nuclear plants), and can generate power for as little as 4 cents per kilowatt-hour (in contrast to the 6 to 12 cents per kilowatt-hour that were typical for utility-owned coal and nuclear plants in the late eighties).

In California, where much of the independent power industry was concentrated in the mid-eighties, IPPs have helped spearhead the use of resources such as biomass, geothermal, wind, and solar power, which provided 11 percent of the state's electricity in 1993. Although electricity from these power sources typically cost 8 to 12 cents per kilowatt-hour when they were first installed in the mid-eighties, costs fell rapidly as the

technologies improved. A bidding auction for new power plants held in California in late 1993 showed that wind and geothermal energy can now provide power at a cost of just 5 cents per kilowatt-hour, close to competitive with the least expensive natural gas-fired plants. At present, renewable power generators—more than 70 percent of them owned by IPPs—are producing some 12,000 megawatts of electricity, and IPPs are developing additional wind power projects in Wyoming, Texas, Minnesota, and Maine.

Independent power generation was further strengthened by the passage of the federal Energy Policy Act of 1992, which forbids utilities to prevent buyers and sellers of electricity from conducting transactions using available transmission capacity along the utilities' lines. This means that a utility or independent power company in one area can sell electricity to a utility some distance away, using the transmission lines owned by a utility located between them. Previously, the owner of the intervening utility could prevent such transactions from taking place by refusing to make transmission capacity available.

The new law has already heightened competition in the power business by making possible a much larger number of potential transactions; it could greatly increase independents' share of the power market in the years ahead. Some analysts have concluded that the utilities' days of monopolizing the generation and transmission of power may be numbered. Long-term trends may turn out to be even more radical: over the next two decades, increased competition may speed the adoption of new technologies that begin to displace large, centralized power plants.



Many independent power producers have specialized in building small-scale sources that can be used to cogenerate heat for industrial use as well as electricity.

Decentralized Generation

Some of the most important advances are occurring with the smallest technologies: microgenerators, such as fuel cells and solar cells, could allow electricity to be produced right in a customer's building. Basement-housed fuel cells or rooftop-mounted solar cells could be linked to existing power networks—the "grid"—reducing but not eliminating reliance on large-scale power generation. Decentralized generators would improve the overall efficiency of the system because less energy would be lost in transmitting electricity across long distances.

Fuel cells are electrochemical, batterylike devices that transform fuel efficiently into electricity. They produce minimal air pollution and virtually no noise. The hydrogen that powers them can be obtained from natural gas—the most common heating fuel used in American homes—through a relatively simple, heat-driven process. A number of different types of fuel cells are now under development, some with government support.

Several companies, including Southern California Gas, have already installed fuel-cell generators to provide power in hospitals and other buildings. The capacity of each fuel-cell generator ranges from 200 to 11,000 kilowatts; the waste heat the generators produce can be used to heat water or space. Allied Signal, a major aerospace company based in southern California, is now developing a prototype 5- to 10-kilowatt fuel cell for home-scale use.

ONSI Corp., a United Technologies subsidiary that manufactures fuel cells, recently joined with ENRON Corp., the largest U.S. natural gas company, to market fuel-cell systems. The ONSI/ENRON

team will function like a mini-utility: it plans to own, operate, and maintain fuel-cell units that will provide power and heat in customers' homes. Customers will pay only for the energy provided, without bearing the risk or cost of actually owning the systems.

The main challenge these companies face is to bring down their costs by developing less expensive materials and production techniques. So far, the technology has advanced rapidly; while it will take time for fuel cells to penetrate the market, it seems reasonable to expect that within a decade, new buildings could be equipped with natural-gas-powered fuel cells that simultaneously generate electricity, heat water, and even provide air-conditioning.

Another promising power-generation technology—the photovoltaic (PV) solar cell—also lends itself to decentralization. First developed by Bell Labs in the fifties and used extensively in the space program, photovoltaic cells are semiconductor devices, usually made of silicon, that emit electrons when struck by sunlight, thereby producing an electric current.

Over the past 20 years, the cost of PV cells has declined dramatically, from more than $70 per watt in the 1970s (in 1994 dollars) to $4 per watt today, and is expected to decline to less than $2 per watt within a decade, according to the National Renewable Energy Laboratory in Colorado. As a result, the potential applications have multiplied. World shipments of photovoltaics doubled from 34 megawatts in 1988 to 70 megawatts in 1994; that year alone, production rose 16 percent, according to preliminary estimates by PV industry consultant Paul Maycock.

Solar PV cells can be deployed on almost any scale. Japanese, Swiss, and U.S. manufacturers have developed experimental "solar tiles" that could become a common roofing material, sheltering occupants while powering their appliances. In Europe, the leading producer of architectural glass, Flachglas, has developed a semi-transparent "curtain wall" that provides filtered light as well as electricity. Corning Glass and Siemens Solar USA have set up a joint venture to develop a similar product.

While rooftop PV systems are already used in 250,000 homes worldwide, usually in remote areas lacking other access to electricity, they have an even greater potential market in buildings connected to the grid. In Switzerland and Germany, more than 1,000 solar-powered, grid-connected buildings have been built in recent years, mainly as a result of government demonstration programs; thousands more are planned. In the United States, a coalition of more than 60 utilities, in conjunction with the federal government, announced plans in 1993 to install 50 megawatts' worth of solar cells by 2000, much of it integrated into buildings and the rest used in larger, grid-connected generators. The goal is to help utilities gain experience with PVs while spurring the growth of the market.

Fuel cells and solar cells have the potential to increase greatly the overall economic efficiency of the power system. Roughly a third of the cost of selling power to residential consumers—and in some cases far more—comes from transmitting and distributing it. If a utility builds a tiny power plant in a customer's own building, it avoids much of that need. Therefore, generating power in a customer's basement for 6 cents per kilowatt-hour may sometimes be more economical than generating it from a remote coal-fired plant for 4 cents per kilowatt-hour. Utilities could take advantage of this price difference to purchase excess electricity from their customers for local distribution, instead of buying from plants owned by other utilities. As these small-scale technologies are commercialized in the years ahead, the line between electricity provider and customer will fade.

Smart Utilities

Integrating these small generators into the power system will be made easier by the use of two-way communications to monitor and control the power system down to the level of the individual home appliance. Each coal plant, fuel cell, and air conditioner could be linked to a utility's computers so that the grid operates as a single "smart" system, turning generators and appliances on and off as needed.

Electric utilities already own thousands of miles of fiber optic cable, primarily along their main transmission lines. Utilities have traditionally used those lines to provide communications between their dispatchers and their power plants, and have recently started to rent excess capacity to telephone companies. Facing growing competition and a changing marketplace, some utilities are starting to explore the possibility of putting their communications systems, along with their existing power-line connection to nearly every building, to new uses.

In an experiment in the Chenal Valley neighborhood of Little Rock, Ark., the Entergy Corp., a large regional electric utility, has installed unobtrusive, wall-mounted home computers that enable two-way communication between home and utility and permit on-site optimization of energy use.

Consumer demand fluctuates over the course of a day, peaking at midafternoon in the summer, for example, when demand for air-conditioning is high, or in the early evening, when dishwashers, lights, and televisions are on. Entergy provides "real time" electricity pricing to customers, who use the computers to program their air conditioners, washing machines, and other devices

to turn on when demand is low and electricity is available at less expensive rates. Chenal Valley residents pay rates that range from 4 cents a kilowatt-hour at times of low demand to 24 cents a kilowatt-hour during peak periods in the summer. This breakdown of prices reflects the range in the real cost of electricity. For most U.S. residential users these costs are masked by an average price of 8 cents a kilowatt-hour.

Entergy projects that real-time pricing, combined with electronic controls, will increase the overall efficiency of the system by reducing peak power demand and, with it, the need for spare generating capacity. In fact, for each new household Entergy hooks up in Chenal Valley, the utility estimates that it avoids having to install an additional 1.5 kilowatts of capacity, saving $1,200. Since the telecommunications system costs $850, the utility saves $350 per household. Based on these results, Entergy plans to expand its pilot program to 30,000 more households.

In 1994, Pacific Gas & Electric announced a joint venture with cable-television giant Tele-Communications Inc. (TCI) and software leader Microsoft to provide similar services to residential customers by means of their TVs and cable boxes. TCI will supply the cable television service while Microsoft will write the operating software and PG&E the applications software. The system will read meters, detect power outages, provide real-time pricing, and allow customers to use a device similar to a TV remote control to program individual appliances. The consortium plans to market the system nationally once testing is complete, and hopes to tap into the huge customer bases of TCI and Microsoft.

In another experimental program, Consolidated Edison wired a Marriott Hotel in New York City to gauge the impact of real-time pricing. The price of power averages 13 cents per kilowatt-hour in New York City, but real-time prices vary from 4 cents to $2.50. In the test, devices such as air conditioners and ventilation fans were programmed to turn on when electricity prices were lower—in the late morning rather than early afternoon—then to turn off for brief intervals during phases of peak power demand, before resuming continuous operation after the peak demand passed. The flow of cool air to occupied rooms was not affected, and the hotels' customers did not notice the difference. Overall, the hotel saved more than $200,000 worth of electricity in the first summer of testing.

Electronic communications between suppliers and consumers will become increasingly important with the emergence of thousands or even millions of decentralized microgenerators. Like appliances, microgenerators can be programmed to respond to price information, so that they provide power to the grid when demand is high and store it in devices such as flywheels—essentially mechanical batteries—when demand is low. A "smart" power system can use price information to fine-tune the balance between electricity supply and demand, increase the efficiency promised by these new technologies, and reduce costs throughout the entire power system.

Because energy management requires no more than 5 percent of the capacity of a fiber optic cable, a utility could lease the bulk of its capacity to companies that provide other information services such as home shopping, travel reservations, and stock quotes. More joint ventures like that linking PG&E, TCI, and Microsoft are likely if a new telecommunications law allowing utilities to invest directly in telecommunications companies is approved by Congress this year.

Shaping a New Industry

As in telecommunications, the electricity industry will adopt new technologies expeditiously only if federal and state legislators take steps to reform the antiquated laws that govern it. Regulated utilities are consistently slow to take advantage of new technologies or to rise to the challenge of competition. In fact, they have little incentive to be efficient. Most utilities earn a fixed rate of return based on the amount of capital they have invested in power plants and other equipment. It is simply not in their interest to invest in competing technologies or those that would conserve electricity.

Opening the industry to competition is essential to speed the process of change. And it may be inevitable as well. Since enactment of the Energy Policy Act of 1992, a vigorous debate has begun over how to reshape the power industry. The most far-reaching and effective proposals focus on its vertical disintegration, fostering competition at the wholesale level while permitting regulated monopolies to operate in the parts of the business—transmission and distribution—where competition is counterproductive. This would organize the industry along the lines of today's phone industry: since the court-ordered breakup of AT&T in 1984, local phone service has remained a local or regional monopoly, but long-distance service is a competitive business characterized by rapidly declining costs.

Vertical disintegration would allow society to balance economic and social goals. While power producers could pursue the goal of generating electricity at the least cost, local distribution-oriented utilities could ensure that social goals, such as improving energy efficiency or protecting the environment, are met. (For example, distribution utilities could help customers finance energy-efficiency investments or purchase a minimum share of their electricity—say

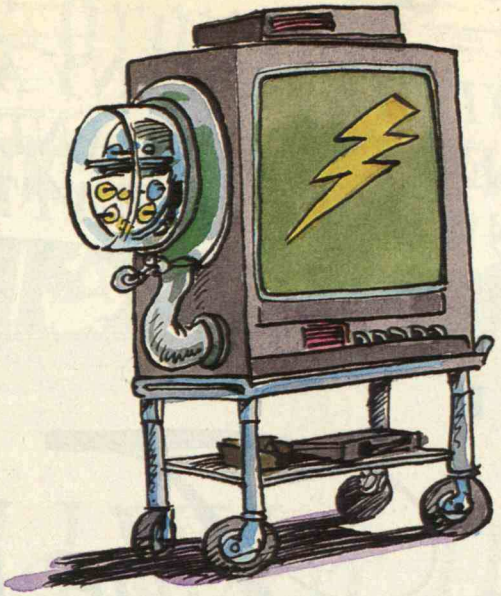
10 to 20 percent—from plants that do not burn fossil fuels.)

The first step in the vertical disintegration of the power industry would be for federal and state regulatory commissions to remove ownership of long-distance transmission lines from existing utilities. The transmission system would then be separately owned by a company that operates only in that business, so that buyers and sellers can transact freely. The Federal Energy Regulatory Commission, which has jurisdiction over interstate power sales, would determine the company's rate of return.

The second step would be for utilities to sell their central generating plants to independent power producers, under the guidance of federal and state regulators. This would make wholesale power generation a truly competitive industry. These companies would compete for the right to sell power to local distributors—just the way the natural gas industry operates today.

Finally, the distribution of electricity would remain the province of local utilities, which would be either municipally owned or regulated by local or state government. Their role would be to purchase power for the community from a variety of sources and ensure that local needs were met.

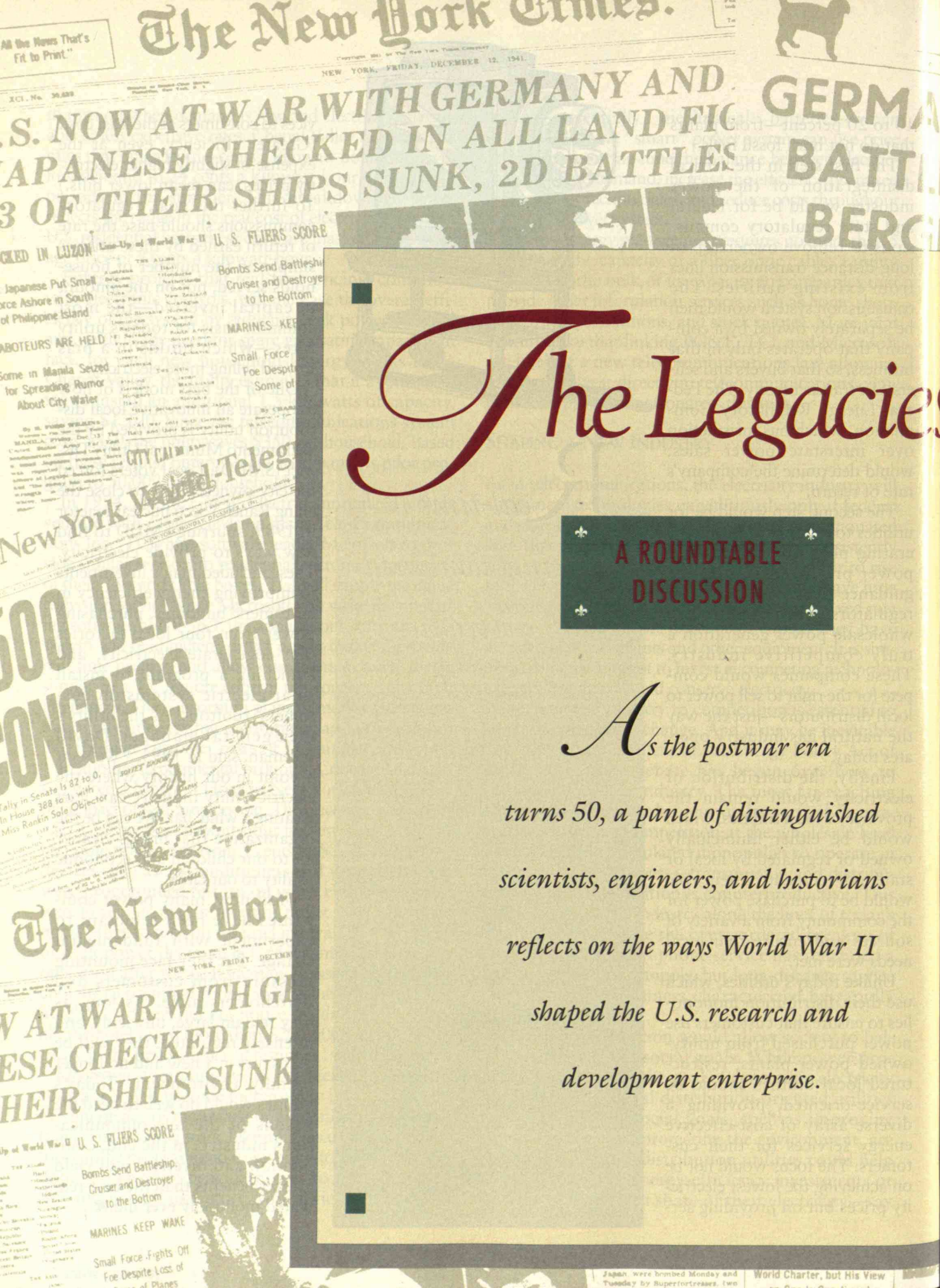
Unlike today's utilities, which use their distribution monopolies to ensure that customers use power purchased from utility-owned power plants, restructured local utilities should be service-oriented, providing a diverse array of cost-effective energy services for their customers. The focus would not be on achieving the lowest electricity prices but on providing services to consumers at the least cost. (Greater efficiency, even at the expense of slightly higher electricity prices, can mean lower bills.) To further this goal, regulatory commissions should base the rate of return earned by these utilities simply on the number of households served, not on the amount of capital invested—the most common basis for today's utility rates—which builds in a bias toward selling more electricity.



Real-time pricing, combined with electronic controls, will increase system efficiency by reducing peak power demand and, with it, the need for spare generating capacity.

One of the best models of how to operate an innovative local distribution utility is provided by the Sacramento Municipal Utility District (SMUD). Local voters forced the city-owned utility to close the ailing Rancho Seco nuclear reactor in 1989, spurring SMUD to find new ways to provide electricity. These included major investments in improving energy efficiency in customers' buildings, purchasing power from four local factories that cogenerate electricity, and launching a program to install solar electric systems on customers' rooftops. As the utility's then general manager, David Freeman, said in 1993, "We're at a point in our history where the electric utility industry can start wearing a white hat. We can be the organization that brings cleaner air to our children and economic vitality to our cities."

Until now, many power companies have been reluctant to experiment with fundamental change. But they face mounting pressure from customers and shareholders alike. As long as they remain large, unwieldy, and intensely regulated, they will be dinosaurs in a new and no longer friendly environment. Today's utilities would do well to heed the lessons of the telecommunications industry: in the end, competition and diversity will yield greater benefits than the best-regulated monopoly ever did.■



The Legacies

A ROUNDTABLE DISCUSSION

As the postwar era turns 50, a panel of distinguished scientists, engineers, and historians reflects on the ways World War II shaped the U.S. research and development enterprise.

of World War II

A SEMI-STRICT policy of this magazine forbids any article from beginning with yet another reference to *Science—The Endless Frontier,* the insightful, influential, but overcited report that Vannevar Bush presented to President Franklin D. Roosevelt in July 1945. Still, as the document that spawned the National Science Foundation reaches the half-century mark, we can allow ourselves to revisit at least the premise under which it was created. In commissioning the report from his director of the Office of Scientific Research and Development in November 1944, Roosevelt declared: "New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life." ✣ The conception of science as a frontier was of course nothing new; Bush himself observed that federally supported pioneering of science had a long history, emblematized by institutions like the Naval Observatory and the Geological Survey. What was new was the staggering wartime demonstration of the advances that the nation's scientific talents were capable of yielding when fully mobilized. ✣ For some five years, U.S. laboratories—funded by the Office of Scientific Research and Development, the Office of Naval Research, and other agencies—produced one technical coup after another. Radar found uses in gun sights, bomb sights, and proximity fuses—devices that enabled explosive projectiles to destroy tar-

THE PARTICIPANTS

- HARVEY BROOKS is a professor emeritus of technology and public policy in the Kennedy School of Government and a professor emeritus of applied physics in the Division of Applied Sciences at Harvard University. He is a coauthor of *Beyond Spinoff: Military and Commercial Technologies in a Changing World* (Harvard Business School Press, 1992) and the author of *The Government of Science* (MIT Press, 1968). During World War II he was a staff member of the Harvard Underwater Sound Laboratory.

- JAY W. FORRESTER is a professor emeritus and senior lecturer at the MIT Sloan School of Management. During World War II in the MIT Servomechanisms Laboratory he developed remote-control systems for Army guns and Navy radar antennas. Later he founded the field of system dynamics, dealing with the behavior of business and social systems, and authored *Industrial Dynamics* in 1961, *Urban Dynamics* in 1969, *Principles of Systems* in 1968, and *World Dynamics* in 1971 (all Productivity Press, Portland, Ore.).

- PHILIP MORRISON is a professor emeritus of physics at MIT. As a nuclear physicist during World War II, he worked on the Manhattan Project at the University of Chicago's Metallurgical Laboratory and at Los Alamos Laboratory. He has since distinguished himself in astrophysics with his research on cosmic rays and his pivotal role in the Search for Extraterrestrial Intelligence (SETI).

- ALEX ROLAND is a professor of history at Duke University and a resident fellow (1994–95) at MIT's Dibner Institute for the History of Science and Technology. He has served as NASA historian and has written extensively on the development of military technology.

- STEPHEN VAN EVERA is an associate professor of political science at MIT and former managing editor of *International Security*. He is an authority on the origins of world wars, including the Cold War.

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- HARRY WOOLF is professor-at-large emeritus and former director of the Institute for Advanced Study in Princeton, N.J. As a historian of science, he has served on the faculties of Johns Hopkins University, the University of Washington, and other schools. During World War II he served in the U.S. Army in the Pacific.

MODERATOR: DAVID BRITTAN, senior editor, *Technology Review*

gets even by a near miss. Soldiers traveled in amphibious vehicles and launched antitank rockets from bazookas when they got there. The wounded received penicillin and blood plasma, both mass-produced for the first time.

Back home, industry honed management and manufacturing techniques to the point where merchant ships could be built in 50 days instead of 35 weeks. The field of electronic computing, embodied in gargantuan machines like the ENIAC, crackled into high gear. And in the laboratories of the Manhattan Project, an army of researchers prepared the weapon that would dominate the war's final act.

That was 50 years ago. Yet people still marvel, as FDR did, at the "vision, boldness, and drive" that propelled research and development in the United States throughout World War II. On a recent afternoon, *Technology Review* convened a group of researchers and scholars to inquire about the conditions that allowed wartime science and engineering to flourish so conspicuously. We also wondered how the World War II experience had molded the organization and funding of R&D in the decades since, and whether there was any way to recapture in peacetime the unity and sense of purpose that drove science in wartime.

TR: An incredible number of innovative technologies were either developed or brought to fruition during World War II. What was the magic ingredient?

BROOKS: I think the magic was a very simple word. It's spelled M-O-N-E-Y. The availability of funding permitted people to take much higher technical risks than ever before.

WOOLF: It was more than that—it was survival, I think.

MORRISON: It was devotion.

FORRESTER: Plus national commitment.

WEAVER: There was a clear enemy.

WOOLF: A clear and present danger in the ascent of fascism and Nazism.

MORRISON: Let me mention, as someone who was recruited to work on the Manhattan Project at that time, that I wasn't recruited by being offered more money or better conditions or a happier place to work. No, I was recruited because they said, "We need you, this is the most important thing," and I could understand that need.

WOOLF: It was leadership, then.

MORRISON: No, it was not. It was the newspapers. The leadership was fine, but the newspapers told me about the German armies advancing, and it was not necessary to convince me that if they were the first to get nuclear weapons, it would not be a very good thing.

PHOTOS OF PANELISTS: MARK OSTOW



The way they were (left to right): Philip Morrison, Manhattan Project physicist, Los Alamos; Ellen C. Weaver, Manhattan Project chemist, Oak Ridge; Harry Woolf, U.S. Army, Pacific Theater.

FORRESTER: There was also a national commitment that swept away a lot of the bureaucratic impediments so that there was great freedom at the operating level. In my own case, as a research assistant in the MIT Servomechanisms Laboratory, I signed drawings in the name of the chief of army ordnance and sent them off to manufacturing companies. That complete bypassing of all of the normal routine meant you could operate much more quickly.

WEAVER: One was also able to commandeer the devotion of people who normally are very free spirits and would want to go their own way. And these mavericks would buckle down and apply themselves in the common cause—something they wouldn't do outside of wartime. You got the very best talents and then let them do what they were good at and gave them support.

TR: Could the technological development that took place during World War II have proceeded so spectacularly without some very solid policies at the national level, some particular kinds of institutions?

ROLAND: Our prior experience had been that when we wanted scientific and technological talent, we just drew it into the services. That's what we had done in World War I—we just signed people up. But in World War II, through the mechanism of first the National Defense Research Committee and then the Office of Scientific Research and Development, which funded most of the applied research for the government, we left people in place at their research institutions and the government contracted with them for products it wanted. The OSRD was run by scientists and engineers who made it their business to listen to what military needs were and also to stay in touch with the scientific and engineering community to find out what they could do, and make a match. It was the clearinghouse of ideas and funds.

BROOKS: Isidor Isaac Rabi, the Nobel physicist, called this the "whole-problem approach"—the scientists listened to the problems of the military but redefined them in terms of what they thought was feasible. The OSRD delegated most of the actual management to the laboratories. The MIT Radiation Lab [which developed numerous microwave radar systems] pretty much made its own agenda. The Radio Research Lab at Harvard, the Proximity Fuse Lab at Johns Hopkins—they were each run by a very strong leader, with talented group leaders working in a "hands-on" role.

MORRISON: Often there wasn't even an assigned task. In the case of the Manhattan Project, scientists pressed the task upon the government. There was no military demand for the atomic bomb. A general in Washington didn't say to General Groves [who became head of the Manhattan Project], "Go



"During the war we were able to commandeer the devotion of researchers who normally are very free spirits. You got the best talents and let them do what they were good at."

Ellen Weaver

out and develop the atomic bomb—we need a thing made out of uranium." He had never heard of it before. He didn't even know what a kilogram was when he was told about the project. It was the scientists who went to the government and said, "This device is probably going to determine the war, or very close to it. We must be involved." And after going from pillar to post they finally found someone who would listen.

TR: How important was M-O-N-E-Y?

BROOKS: A lot of critical decisions were made that would never have been made had there not been ample resources. The Manhattan Project was a clear example. It had about five or six different routes to the bomb going at once, and in retrospect that looks awfully wasteful because you can now see which was the most successful route. But nevertheless I think that proliferation of routes in competition with each other was a very important factor, and that is the main reason high levels of support were so critical.

FORRESTER: Even the most successful route might not have been successful if it had been the only one.

The Legacy of Wartime Research

TR: You've all been describing a process in which scientists basically said, "This is what we want to build. We would like funding according to the following plan." Did this kind of initiative continue after the war?

WEAVER: At the end of the war, when I was still at Oak Ridge National Laboratory, the public's attitude toward atomic energy was basically that the only thing it could do was blow up the world. Philip Abelson, the physical chemist who developed one of the uranium separation processes used in the atomic bomb, and who was staying with us at the time, thought one way to deflect this public concern would be to demonstrate that atomic energy could be used as a source of electrical energy. So for about six months he and an engineer named Chad Raseman spent some of their time holed up in our third bedroom preparing a detailed feasibility design of a nuclear-powered submarine for the Navy. After another two years, Admiral Rickover was assigned the task of building such a vessel.



"IN THE CASE OF THE MANHATTAN PROJECT, SCIENTISTS PRESSED THE TASK UPON THE GOVERNMENT. THERE WAS NO MILITARY DEMAND FOR THE ATOMIC BOMB."

PHILIP MORRISON



FORRESTER: That sort of initiative also persisted at the MIT Lincoln Laboratory, at least in the immediate postwar period. Several of us in the laboratory had a vision of building a computer-controlled air defense system. Now that was a radical, harebrained idea as viewed by any sensible person at the time. Trouble was, the Air Force had no alternative to propose, so they funded us. The Lincoln Laboratory operated for several years on this basis—we'd tell the government, "This is what we think you should do. Agree with us and pay for it, or cut off the money and we'll go do something else." Unfortunately, this is an attitude that dissipates very fast. You take the Lincoln Laboratory after that first three or four years and you get what is true of almost all of them. People now have a budget, and they have employees, and they have to keep this operating, and they become more and more acquiescent to the sources of money.

BROOKS: Similar things have happened in the way the Department of Energy's national laboratories are managed. Today a lab like Brookhaven has to report to 15 or 20 different DOE offices that don't talk to each other. In general, the decision-making authority has moved upstairs to a bureaucracy that has little hands-on experience with the technology. They're often very smart and dedicated people, but they're distant from what's going on.



Jay W. Forrester (standing, fourth from left) in 1939, with members of the MIT Department of Electrical Engineering, many of whom performed pioneering wartime research on microwave radar, gun-positioning mechanisms, and digital computing.

TR: Is it fair to say that military patronage of research and development has been a more enduring legacy of the war?

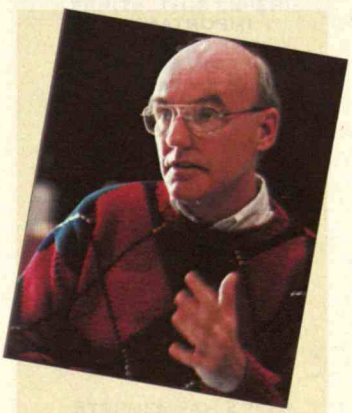
ROLAND: There's no question about it. World War II demonstrated how quickly scientific and engineering knowledge could be turned into truly important weapons if the government's resources were directed to that end, and that, I think, is what chastened the military after the war. The services were left with the feeling that it behooved them to cultivate science and technology continuously, as opposed to just drawing upon it episodically and mostly for development.

WOOLF: Incidentally, that included sending technically or scientifically trained officers to graduate school.

BROOKS: In looking at the importance of military funding of R&D, you have to remember that the initial budget of the National Science Foundation [the largest civilian funding source for the physical sciences after the war], was only $3.5 million a year. It was not until 1961 that NSF had an annual budget of over $100 million dollars. Before NSF blossomed, the main funding agency that was at least quasi-civilian was the Office of Naval Research. While it was ostensibly a military office, "military" was interpreted in an extremely broad way. A great many basic investigations that later became very important—like radio astronomy—would never have existed without the initial support of ONR. People who date from those days still look back nostalgically at ONR in many ways as the most flexible and enlightened agency for the support of basic research. It accounted for some 75 percent of the support of university research in the early 1950s, at least until biomedical research took off in 1956.

ROLAND: That's right. Immediately after the war, the services—having appreciated that science and technology were now going to be of continuing importance—kept in place many of the structures that had been created during World War II: the Applied Physics Laboratory at Johns Hopkins, the Radiation Laboratory at MIT, and a host of others. The nascent Air Force perhaps took more initiative than any of the other services in creating a whole R&D infrastructure. It set up a scientific advisory board, brought in [aeronautical engineer] Theodore von Kármán to pool scientific expertise and advise them on what they should be doing in the future, and set up their own R&D operations. That was how we got the RAND Corporation [the think tank in Santa Monica, Calif.], for example.

WOOLF: The Air Force even supported pure mathematics. For a long time the only real



"WORLD WAR II DEMONSTRATED HOW QUICKLY SCIENTIFIC AND ENGINEERING KNOWLEDGE COULD BE TURNED INTO WEAPONS IF THE GOVERNMENT'S RESOURCES WERE DIRECTED TO THAT END."

ALEX ROLAND



"A GREAT MANY BASIC INVESTIGATIONS THAT LATER BECAME VERY IMPORTANT—LIKE RADIO ASTRONOMY—WOULD NEVER HAVE EXISTED WITHOUT THE INITIAL SUPPORT OF THE OFFICE OF NAVAL RESEARCH."

HARVEY BROOKS

math fellowships of substance came from the Air Force—because they had had the experience during the war with the proximity fuse and its use of the mathematics of trajectories, flight, and so forth. And they hoped for the same thing again in postwar rocketry and other fields.

TR: Clearly the military did much after the war to nurture basic research. But was it obvious at the war's end, after so many technological triumphs had arisen from *applied* research, that the military would embrace basic science? Is it possible that in proposing the creation of the National Science Foundation, Vannevar Bush was trying to carve out a preserve for basic science?

BROOKS: Actually, there was very little distinction between basic and applied research in Bush's mind. Although he did use the term "basic research" in *Science—The Endless Frontier*, he explicitly denigrated the distinction in a report to the president of Harvard in 1950 making recommendations for Harvard's use of the Gordon McKay Bequest for engineering. He thought each fertilized the other, so you had to bring them along together in a much more symbiotic relationship than in the past.

FORRESTER: I believe that research done in the context of wanting a result can be just as fundamental as any other kind of research. It's simply disciplined by why you're doing it.

BROOKS: Really, you have two streams of research, both important. One is research that is organized by social objectives, and in which the knowledge you seek is determined primarily by the vision of ultimate applications; I call this "need-based" research. The other is determined by a desire to contribute to the conceptual structure of science; I call this "opportunity-based" or "concept-driven" research. The two streams operate in parallel: lots of basic research is fertilized by ideas that were generated as a result of trying to solve an applied problem, and vice versa.

TR: Would you say that the war had some effect on the balance of these two streams?

BROOKS: Yes, I would. One thing that OSRD's experience with wartime research and development showed was that it was dangerous to make premature judgments about what was or was not applicable. The outputs of basic research may be applicable in many different areas and on many different time scales. Clearly, much more research will always be driven by societal needs than by the desire to find general laws and concepts. Today 80 to 90 percent of the research being done is need-based in that sense. But there has to be a margin for opportunity-based research in order to maximize the rate of progress for need-based research.

The Cold War Buildup

TR: Some would argue that the vast postwar patronage of R&D was a way for the military to maintain its influence—that the Cold War itself was less a direct response to the Soviet threat than a way to avoid dismantling the military machine and to prevent a return to economic depression.

ROLAND: The popular perception is that there was a huge military-industrial-academic complex driving the country after World War II. But that notion is at odds with the numbers. In 1944, some 40 percent of the gross national product was being spent on the military. Through the 1950s we were spending only about 10 percent of GNP on the military. For the Cold War overall, the



figure was only 7 percent of GNP.

BROOKS: The reason there wasn't a big depression after World War II is not postwar defense spending but extremely good macroeconomic management during the war. We got through World War II with practically no inflation, so savings bonds and other instruments were almost as valuable at the end of the war as when they were issued. You had all this saved-up purchasing power.

MORRISON: And enormous consumer demand, because nothing had been available during the war.

BROOKS: That unexercised purchasing power was the main reason the aftermath of World War II was so different from that of World War I.

FORRESTER: I disagree. I think you have to look at this great economic phenomenon known as the "long wave." In World War I we were at a peak, after a huge expansion that was destined to be followed by a big downturn. World War II was at the end of that depression, where a recovery, I think, would have occurred anyway. The war was small change compared with the force of the economic long wave.

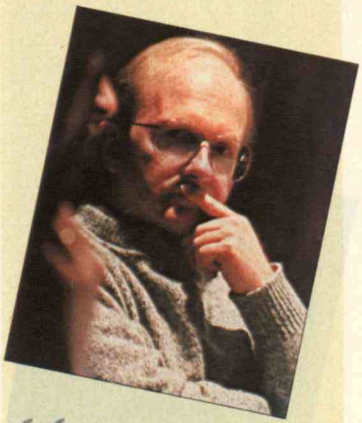
BROOKS: Well, I guess I'm not as much of a fan of long waves as you are. Even if you're correct, I believe that accumulated savings worked synergistically with whatever long-term trends were latent in the economy.

VAN EVERA: It's true that our Cold War military spending was a lot lower than most people think. But 10 percent of GNP is still high compared with other peacetime periods in history, such as the late 1930s, when the figure was 1.5 percent. We went from spending 4.6 percent of GNP on defense in 1950 to 13.8 in 1953 with very little discussion or debate compared with the Reagan buildup, where we went up only about two percentage points and argued about it at great length. So I think the arms race of the '50s and '60s still needs explaining. Whether it was fostered by the World War II–created defense establishment is a good question.

But it's probably simpleminded to say that the defense establishment found ways to perpetuate itself after it was called into being. The main way World War II fostered the later arms race was in changing U.S. political thinking. The war was a great shock to American policy and taught several lessons about arms races. One was the 1919 analogy—the lesson that when you've been in a great European war, you'd better not disarm fully afterward and return to prewar spending levels; otherwise you're going to have to go back and clean up the mess again.

The second lesson was that high levels of peacetime defense spending were not necessarily dangerous. People had two big fears about such spending. One was that it would wreck the economy. But wartime military spending ended the Great Depression and brought prosperity. This experience primed the public to accept the argument that peacetime military spending could help the economy, or at least wouldn't hurt it.

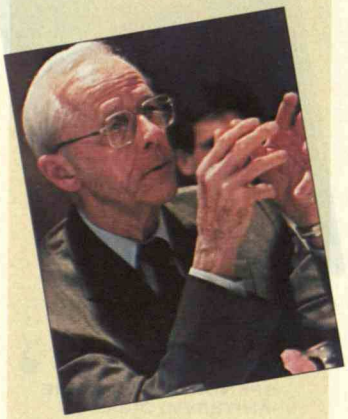
The other fear about postwar defense spending was that it would cause constitutional problems and threaten a garrison-state political upheaval. Yet wartime service gave millions of Americans a close-up view of the military, and left them less leery of it.



> "WARTIME MILITARY SPENDING ENDED THE GREAT DEPRESSION AND BROUGHT PROSPERITY. THIS EXPERIENCE PRIMED THE PUBLIC TO ACCEPT THE ARGUMENT THAT PEACETIME MILITARY SPENDING COULD HELP THE ECONOMY, OR AT LEAST WOULDN'T HURT IT."
>
> STEPHEN VAN EVERA



The soldier and the engineer: General Lesley Groves, head of the Manhattan Project, and Vannevar Bush, computer pioneer and director of the wartime Office of Scientific Research and Development.



"I THINK CIVILIAN SPINOFF FROM MILITARY R&D IS AN IDEA PROMOTED BY THOSE WITH A VESTED INTEREST IN INCREASING GOVERNMENT FUNDING."

JAY W. FORRESTER

TR: Would the Cold War have been possible without nuclear weapons?

VAN EVERA: Nuclear weapons had a kind of Janus-faced effect: they were a major intensifier of the early Cold War and a pacifier of the later Cold War. NSC-68, the planning document written by Paul Nitze in 1950 to explain and motivate the big defense buildup, was the most important national security document of the Cold War. And it scared everybody. It was the trigger for the big buildup to 13.8 percent of GNP on defense. The Korean War happened at the same time, so people ascribe the buildup to Korea. It was really NSC-68. And the main trigger of that document was the Soviet atomic bomb. That was the policymakers' darkest terror.

ROLAND: And the fall of China to the Communists—those two together.

VAN EVERA: Correct. But if you want me to rate them, I'd say the Soviet atomic bomb was number one. Basically, Nitze and others were afraid that the doctrine known as MAD [mutual assured destruction] wouldn't work—that a new world war would follow. Therefore we had to have a massive buildup to keep the Soviets cornered. Later in the Cold War, people finally came to understand that MAD did work, that no aggressor was going to attack anyone who had a deterrent.

TR: Let's speculate for a minute. Suppose there had been no U.S. atom bomb, no Soviet atom bomb, no threat of a German atom bomb. All else being the same, could there have been a Cold War? Would there have been the hysteria, the mutual dread between the Western and Soviet blocs?

ROLAND: Not only that, we would have had a conventional World War III with the Soviet Union, which would have been a disaster.

BROOKS: And it was a very sobering event when the atomic bomb was used in World War II. I'm sorry for the Japanese—but I think that its demonstration on real cities did an awful lot to save the world.

TR: How effective has the Cold War concept of spinoff—the idea that military R&D yields civilian benefits—proved as a form of technology policy?

BROOKS: For a long time there was a big public belief in spinoff, but I think all the research that's been done indicates it's not very important. You get very little spinoff from the overwhelming amount of the expenditure. We got a certain amount from basic research, because basic research is inherently multipurpose. But most of the spinoff probably came from the "R" and not the "D." The problem with evaluating spinoff lies in the question, Compared to what? No R&D or a similar amount of civilian R&D?

ROLAND: NASA used to say that for every dollar you spent on space, seven dollars got spun off back into the economy. And I thought, if that's true we could give them $500 billion and settle the national debt. It's a preposterous notion, and yet that kind of rhetoric has floated around since the Apollo program, especially in funding circles.

BROOKS: There's no question you get a certain amount of spinoff when you spend that much money, but you have to ask what the cost-benefit ratio is. You don't get anywhere near as much benefit if you don't spend directly for the purpose for which you're trying to derive the benefit.

TR: So the great benefits of spinoff are a myth.

FORRESTER: I think civilian spinoff is an idea promoted by those with a vested interest in increasing government funding.

The Next Manhattan Project

TR: I'd like to return to the picture of wartime research and development that was being painted at the beginning of our discussion. According to several of you, the major science and engineering successes of World War II—especially the Manhattan Project—stemmed from individual initiative and a sort of a spontaneous rallying of scientists and engineers around projects they deemed crucial. Granted that war provides a sense of urgency that perhaps can't be duplicated in peacetime, are there any problems today that can or should be tackled with something like a Manhattan Project? In other words, are there any issues around which scientists could get so energized as to insist on a major government-sponsored effort to find solutions?

BROOKS: No, I don't think so. Sustainable

development may be such a problem, but it's so long-range compared with the problems we faced in World War II that I doubt it can be solved by mobilizing the public sector. There's no immediate crisis.

TR: What about climate change? The Manhattan Project model for this would be that a prominent climatologist, a Stephen Schneider, sends the president a letter saying —

WOOLF: The earth is about to die!

TR: Or at least saying that we may have a serious problem soon if we don't gather lots more data and possibly take action before the problem overtakes us. Would that fly?

WOOLF: Not in these times.

MORRISON: Climate is a far harder, more complex, more subtle, more long range, more integrated problem than nuclear fission. It's not even science in the laboratory. We've reached the point where we don't have solutions or even putative solutions to these things. The best idea is to recruit better people to work on them more enthusiastically. We have tremendous tools—like satellites and physical chemistry—that are well developed. But they have to be applied.

WEAVER: Here is a case in point. I was involved in developing NASA's Coastal Zone Color Scanner, which was launched into orbit in 1978. It mapped the chlorophyll in the oceans and revealed a great deal about ocean productivity and the dynamics of ocean currents until 1986. But despite its success, and the enormous impact of the resulting data on ocean sciences, there has been no follow-on satellite-borne sensor. I'm not sure why a proven, relatively low-cost system for detecting ocean color, which has yielded data of inestimable scientific worth, has not been pursued with great vigor.

MORRISON: Because you can't point to the Luftwaffe as the competition.

WOOLF: My favorite example in this area is sexually transmitted diseases. We know a great deal about them. We know we can stop them through modifications in behavior and through further biochemical research. It's a world-scale disaster building—but what are we doing?

TR: Maybe we'd have better luck if we blamed it on the Germans.

WOOLF: I wish we *could* find an enemy for this.

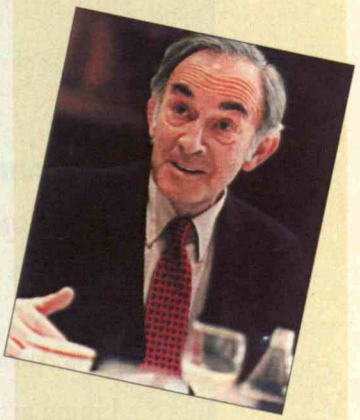
VAN EVERA: You're all underselling the policy effect of scientific research. I'm thinking of instances where the letter you're describing *was* sent, and had an impact. Ozone-layer research has convinced U.S. policymakers of the need for action, and the whole world has changed direction on chlorofluorocarbons. It's a magnificent example of how the world can *respond* rationally when a problem and a solution are *demonstrated* rationally.

WEAVER: One thing we haven't touched on at all that might warrant a Manhattan Project–style solution is overpopulation. The exponential curve is really frightening, yet this issue can't even be discussed rationally in many groups. People tiptoe around it for fear of offending somebody. But the rate of population growth is going to make a disaster of everything else we're trying to do.

MORRISON: I don't believe there's runaway population growth. The maximum percentage growth rate for the world as a whole was passed in 1972. In every continent, it's been falling ever since. Now UN figures say the absolute number of people added each year will probably peak by 2000 or 2005.

WEAVER: If we last that long.

FORRESTER: To be honest, I think the idea that the frontier for humanity is in science and technology has come to an end. We had the frontier of exploring the geography of the earth and the frontier of creating nation-states. We've been in the frontier of science and technology for the last 100, 150 years. But science and technology is now a production line. If you want a new idea, you hire some people, give them a budget, and have fairly good odds of getting what you asked for. It's like building refrigerators. I think the next frontier is in coming to an understanding of our economic and social systems. Our knowledge of human systems is in about the same state as our scientific knowledge was back in 1800. If there are future Manhattan Projects out there, I think they will be addressing such threats as rising population and economic instability. ■



"MY FAVORITE EXAMPLE [OF A PROBLEM THAT MERITS ANOTHER MANHATTAN PROJECT] IS SEXUALLY TRANSMITTED DISEASES. WE KNOW A GREAT DEAL ABOUT THEM. IT'S A WORLD-SCALE DISASTER BUILDING—BUT WHAT ARE WE DOING?"

HARRY WOOLF

BY STEVEN R. HOLTZMAN

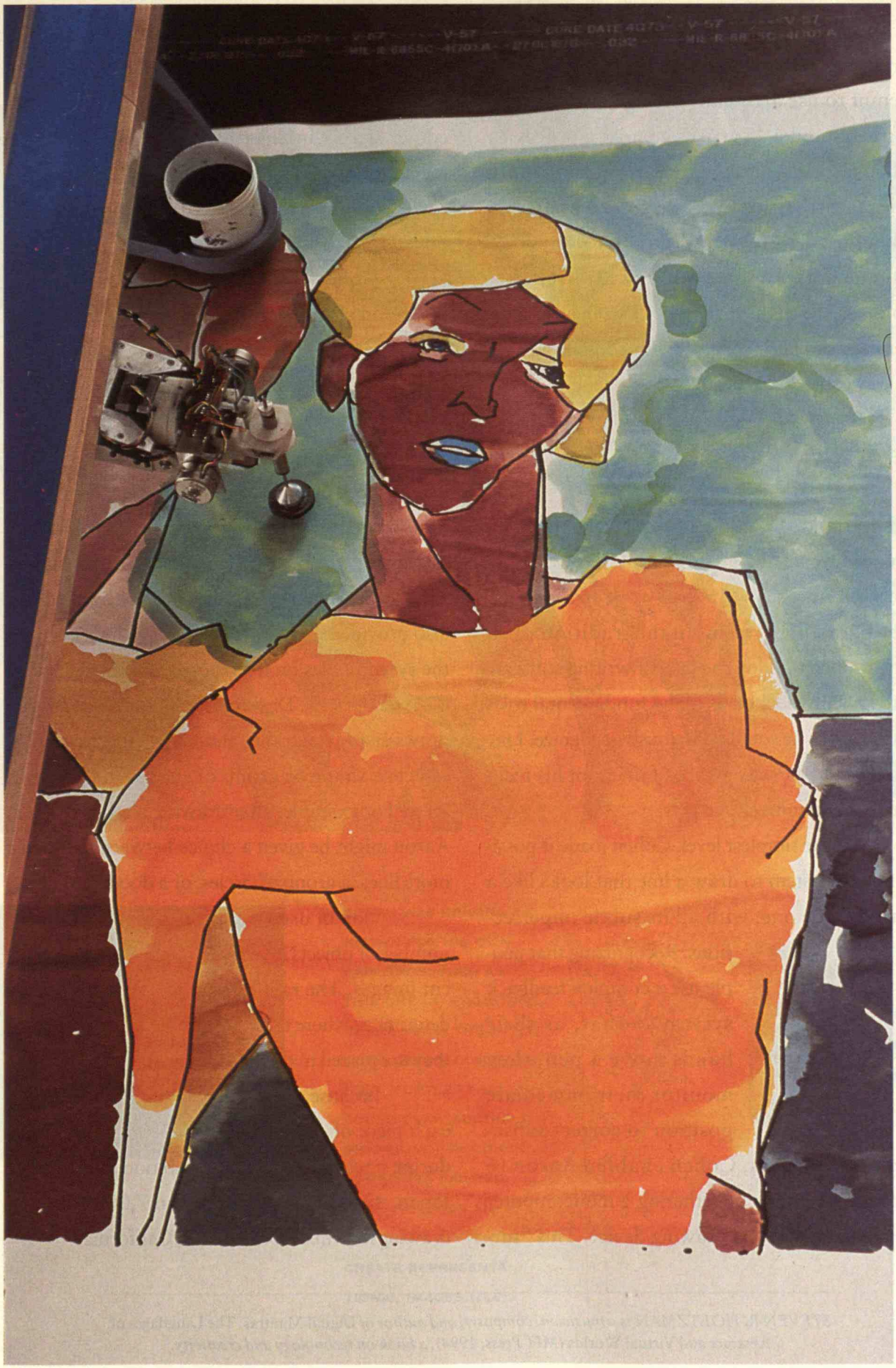
Painting by Number

Over the past quarter-century, a computer system named Aaron has advanced from drawing squiggly lines to painting portraits that look handmade and are hung in major art museums.

This April a "virtual painter" is debuting at the Computer Museum in Boston. Combining artificial intelligence with robotics, it is a machine whose drawings and paintings are so sophisticated that they appear to be made by hand. Harold Cohen, who in the 1960s was one of Britain's leading abstract artists, has developed the machine over the past 27 years. ■ Trained at London's prestigious Slade School of Fine Art, Cohen first became recognized for his use of dramatically contrasting colors (*A*, page 62), a style that preceded techniques employed in Pop art. In 1966 he represented the United Kingdom at the Venice Bienale, then the leading international art exhibit, and museums worldwide continue to display his abstract work. ■ While a visiting professor at the University of California at San Diego (UCSD) in 1968, Cohen discovered computers. Over time he became intrigued with the idea that they could be used to create art, and eventually abandoned traditional painting to pursue the development of a computerized system that could draw and paint in the style of an actual person. Now director of the Center for Research in Computers and the Arts and professor emeritus in the Department of Visual Arts at UCSD, Cohen came to recognize that part of his motivation stemmed from his feeling that the art world was cutting itself off from mainstream audiences. He began to think that computers might help bridge the gap by attracting people to the physical processes used in making art. ■ Cohen's system, which he named Aaron simply because he liked the name, repre-

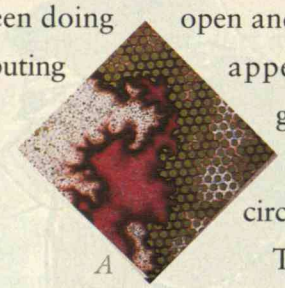


■ ABOVE: HAROLD COHEN (LEFT) WITH RESEARCH ASSISTANT VAL VALGARDSON. OPPOSITE: COHEN'S SYSTEM BRUSHES IN COLOR ON A 1995 IMAGE.



PHOTOS BY BECKY COHEN

sents what seems to be the first sophisticated attempt to use artificial-intelligence (AI) techniques to model an artist's cognitive processes. Cohen also sees his computer work as part of a typical artist's drive to create new techniques in making art. "Art to some degree has always been a commentary on the nature of art itself," he explains. "In that sense, what I've been doing over the past 25 or so years with computing is a very orthodox procedure."

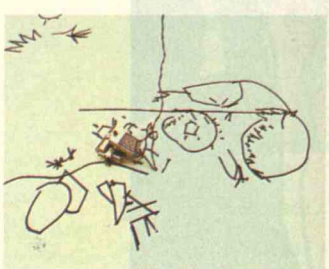


A

Developing a Turtle

After learning of Cohen's interest in computers, AI pioneer Edward Feigenbaum invited Cohen to Stanford University in 1973 to work on a computerized drawing system. In the tradition of AI work, Cohen took on the task of writing software that explicitly defined as many fundamental rules of drawing as he could consciously recognize. Like many artists, he was aware of many of his techniques only intuitively, he says.

At the simplest level, Cohen made it possible for the system to draw a line that looks like a human-made one, with all its subtle imperfections. Recognizing that people use a complex feedback system so that, as their hands move a pen, they monitor their immediate position to correct subsequent movements, Cohen enabled Aaron to mimic such activity by tethering a minicomputer to a six-inch, wheeled drawing device. This "turtle" also included a transmitter for giving positional information to receivers arranged at each corner of a six-by-eight-foot piece of paper. So fitted out for tracking and feedback purposes, the turtle could travel across the paper, raising and lowering its pen as directed (*B*).



B

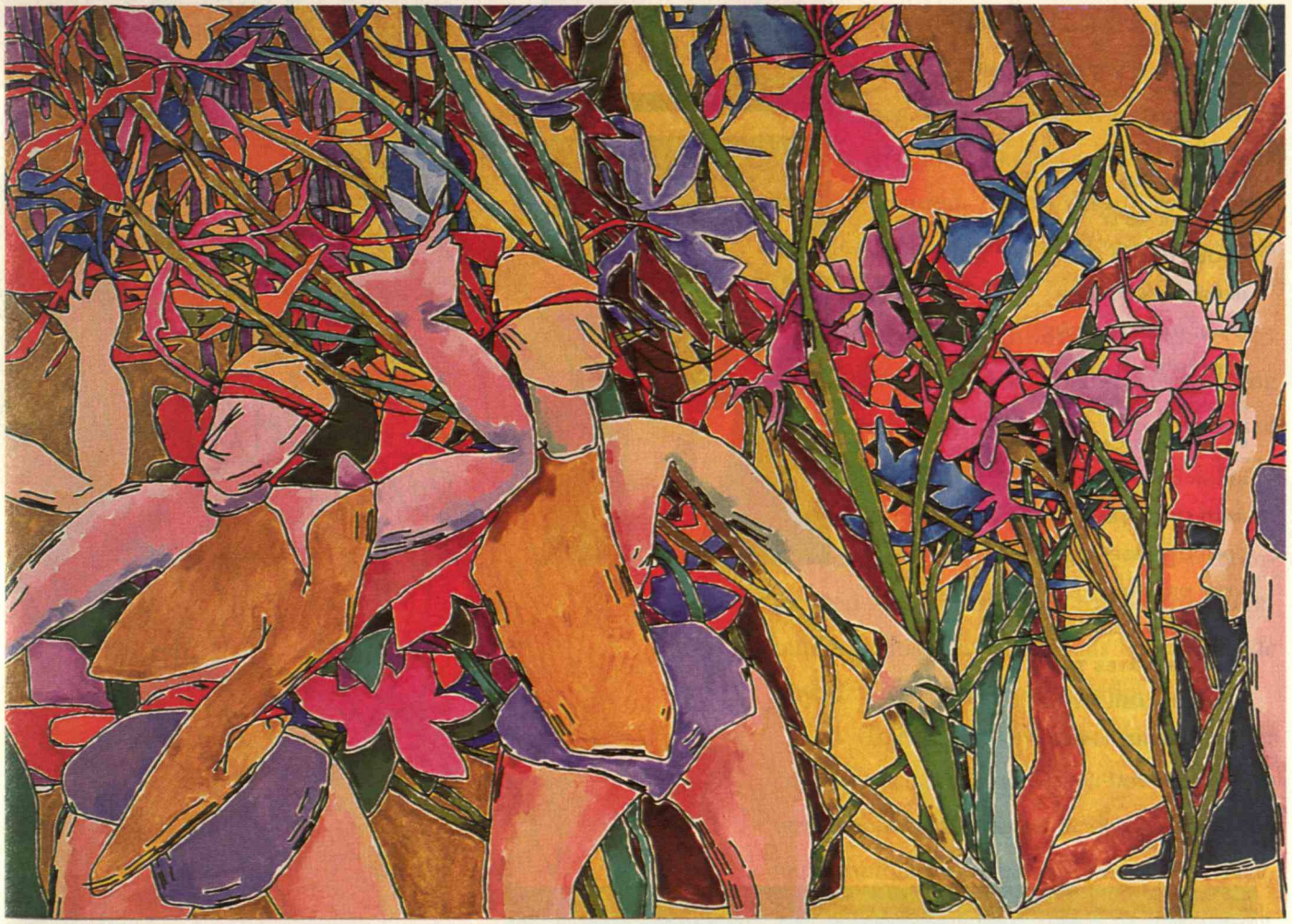
Cohen also created rules for creating open and closed shapes and for making images appear to be in the foreground or background. And he developed guidelines to organize basic shapes such as lines and circles into groups (*C*).

To enable the computer to determine what abstract shapes to draw in an image, Cohen had to outfit the system with more than the elaborate rules that characterize artificial intelligence. He also provided a random-number generator, which the system relies on for repeatedly choosing from a list of options. Depending on what the system draws at any stage, the random-number generator selects a shape or group of shapes for the next stage. For example, after drawing a series of lines, Aaron might be given a choice between sketching more lines, a group of circles, or a doodle.

Cohen used a similar setup so that the number of objects in a group could differ in different images. The random-number generator also determines where the various objects are drawn, if they are placed in the foreground or background.

Because of the random-number generator each piece of Aaron's artwork is unique. In fact, during a recent six-month exhibition in Tsukuba, Japan, Aaron created more than 7,000 different drawings—while Cohen was in California.

STEVEN R. HOLTZMAN is a musician, composer, and author of Digital Mantras: The Languages of Abstract and Virtual Worlds *(MIT Press, 1994), a book on technology and creativity.*

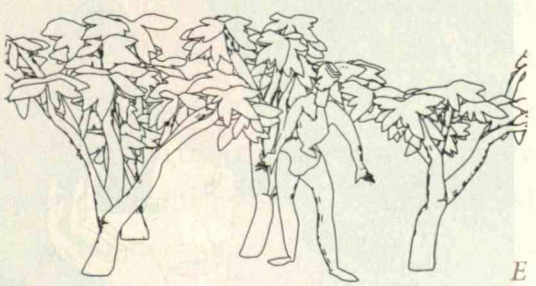


D



C

COHEN WAS ORIGINALLY KNOWN FOR HIS OWN PAINTINGS, SUCH AS THIS ONE (*A*) FROM 1966. IN THE 1970s THE ARTIST DEVELOPED A COMPUTERIZED "TURTLE" THAT COULD DRAW ABSTRACT SHAPES, WHICH COHEN SOMETIMES PAINTED (*B,C*). HE LATER ENABLED THE SYSTEM TO CREATE REPRESENTATIONAL IMAGES (*D,E*).



E

F



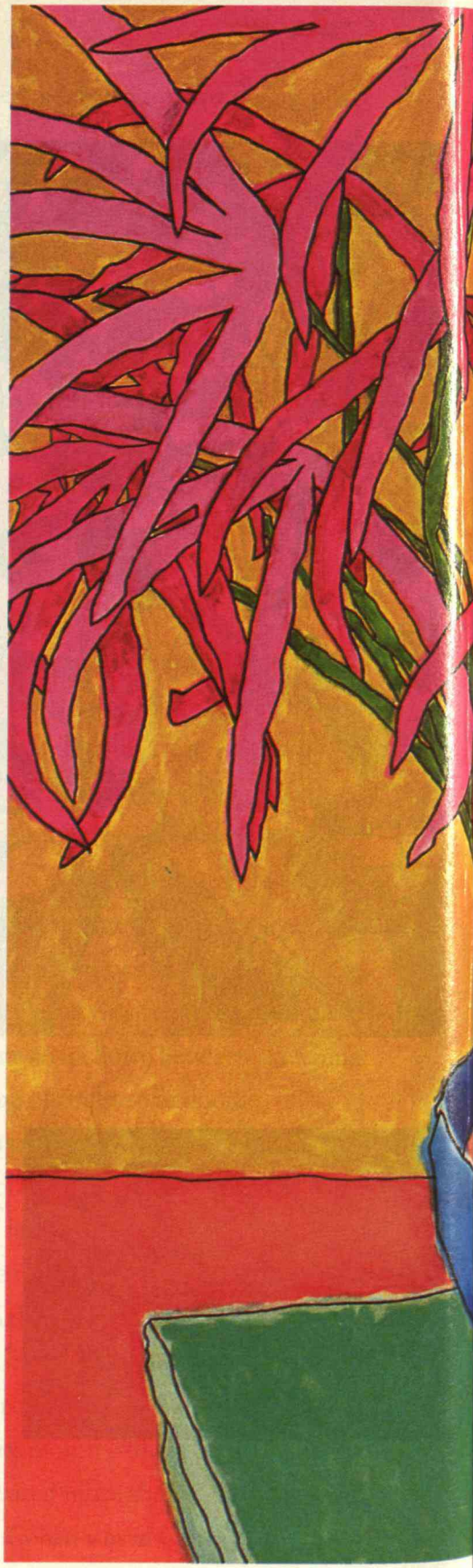
G

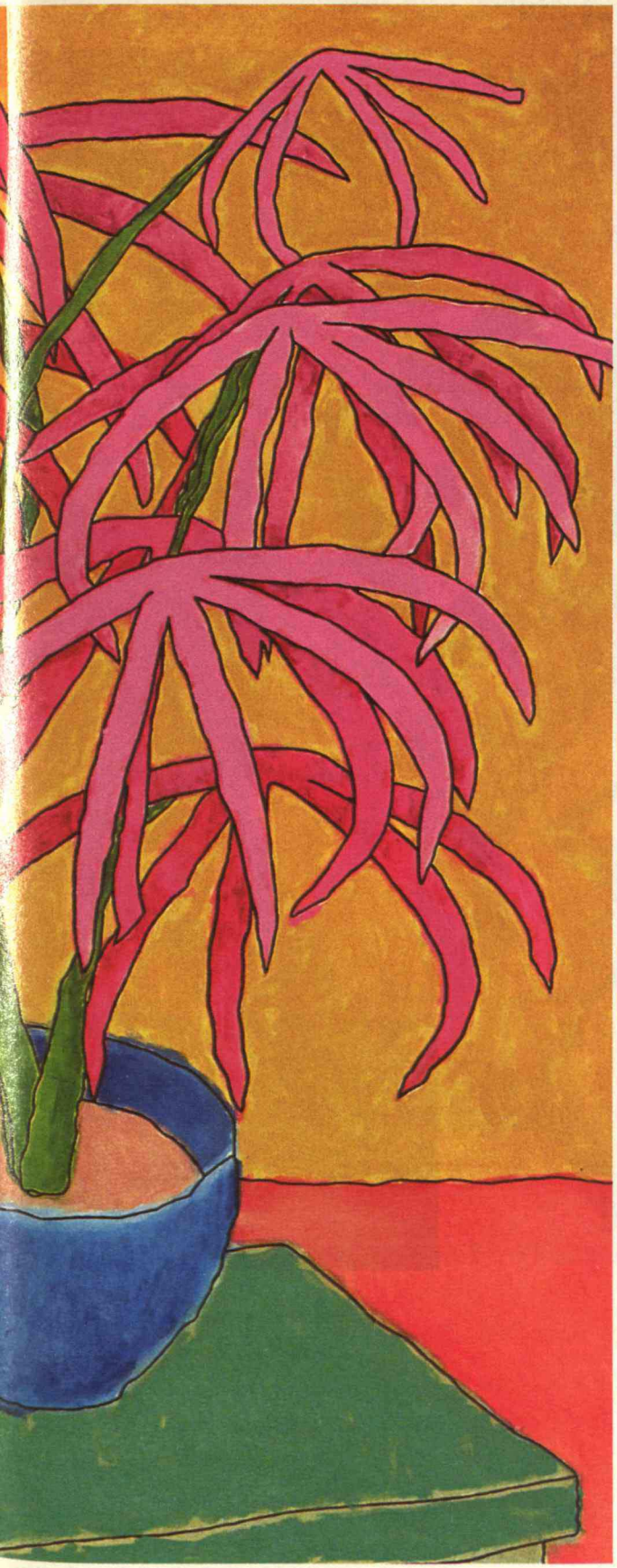


IN 1993 COHEN REFINED HIS MACHINE SO IT COULD COLOR ITS IMAGES ON SCREEN (*F,G*). BASED ON THE SYSTEM'S COLOR CHOICES, HE WOULD PAINT PHYSICAL VERSIONS OF THE DRAWINGS (*H*). A 1991 COMPUTER-GENERATED DRAWING PAINTED BY COHEN DEMONSTRATES THE SYSTEM'S ABILITY TO PRODUCE REALISTIC STILL LIFES (*I*).



H





I

An Abstract Artist Embraces Realism

The year 1980 marked a turning point for Cohen. He felt he had reached a plateau, as his system was able to make a set of primitive shapes. If the device was to produce images that look like art created by a person, he decided, Aaron should reflect the developmental process by which people learn to draw.

Observing children, Cohen recognized that as they develop an understanding of the real world they begin to organize abstract marks into objects and people. He decided, therefore, that his system had to start drawing realistic images. And so commenced what the abstract-artist-turned-computer-scientist describes as his "gradual slide downhill into overt representation."

To enable his system to learn rules for creating such artwork, Cohen not only had to write sophisticated software describing drawing techniques for creating clearcut facial features, for example, but he also had to provide Aaron with extensive knowledge about the world. For example, Cohen provided the system with a host of guidelines, such as that rocks rest on the earth while clouds are in the sky. He embodied within Aaron details about proportions of the human figure when seen at different angles. And he devised more complex methods for creating overlapping objects, to give the drawings depth and realism.

With such rules—and an extension of the random-number-generator process so that before drawing a picture of a human, Aaron could choose, say, how to turn a head

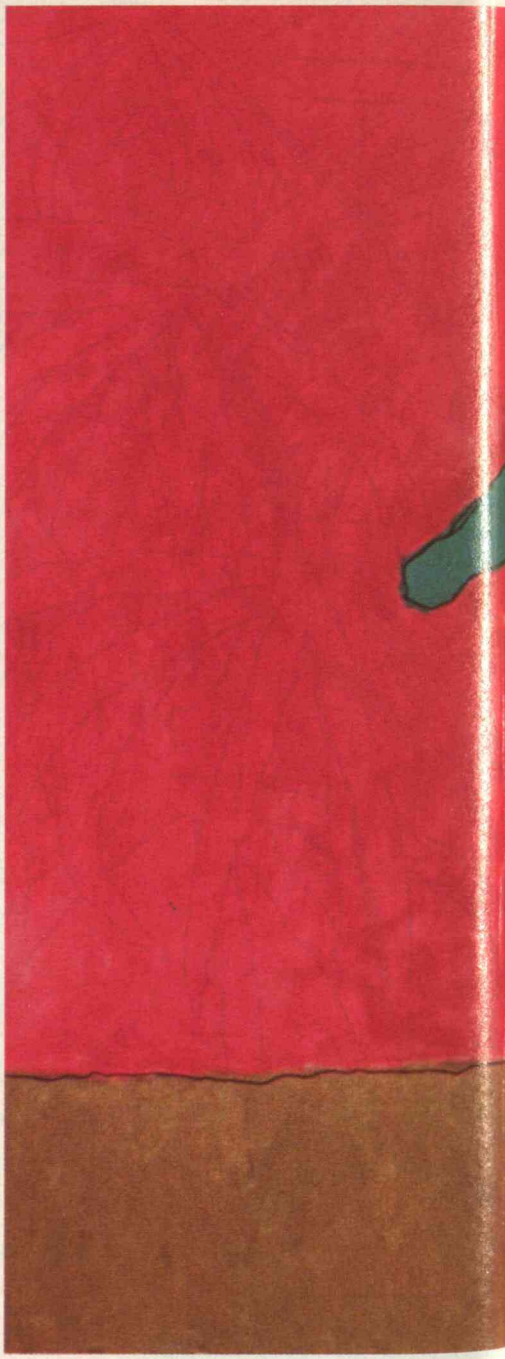
or whether to extend an arm—the system was able to create images such as of people looking at unseen entities while standing within dense jungles of various kinds of vegetation (*D* and *E*, page 63).

An Electronic Palette

While Cohen initially colored Aaron's drawings himself (such as *I-M*, pages 65-68), in the early 1990s he began studying his own abstract work to formalize a set of techniques for allowing the system to color. Cohen provided Aaron with instructions on colors for plant leaves, clothes, and people's skin, for example, and on how to combine particular colors with others. Not surprisingly, given the artist's abstract works, the instructions ensured that Aaron would use blocks of bright and dramatically contrasting colors.

At first Aaron's coloring was restricted to filling in the pixels—individual points—on computer displays (*F* and *G*, page 64). Cohen would then take the results and reproduce them himself with paint on the black-and-white drawings the "turtle" had also made (*H*, page 64). But now Cohen has developed a robotic arm that can move over a table with a handful of brushes attached on one side and more than 20 bottles of color dyes connected on the other. Software instructs the arm to pick up a brush, fill a cup with a dye, dip the brush into the cup, and begin painting. The system empties and rinses the cup before filling it with another color and continuing its painting. Aaron keeps working in this manner for a few hours until it completes a picture (*N*, page 68).

Aaron is now using its techniques to produce convincing portraits and still lifes of flowers. The images may look deceivingly simple to view-

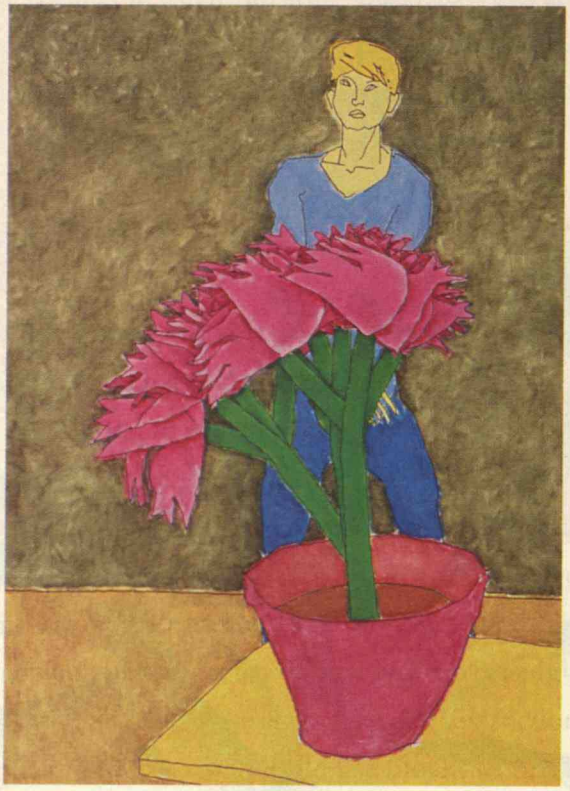


J

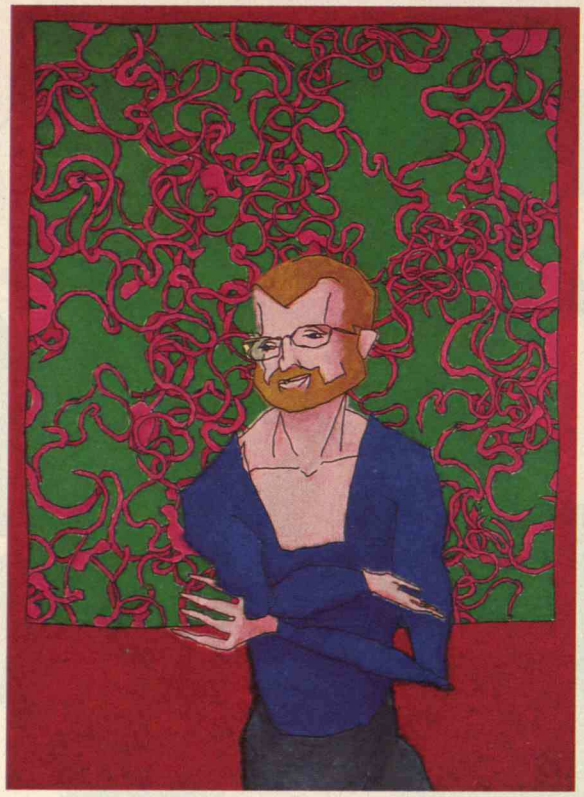
THE COMPUTER SYSTEM'S RULES INCLUDE INFORMATION ON HOW TO MAKE DIFFERENT FIGURES AND BODY PARTS APPEAR TO BE PART OF THE FOREGROUND OR BACKGROUND, SUCH AS IN THESE HAND-PAINTED IMAGES FROM 1991 (*J*) AND 1992 (*K*).



K



L

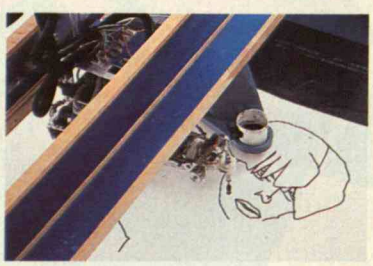


M

ers who do not appreciate the complex drawing and coloring instructions Cohen has devised. But experts have apparently deemed the work so sophisticated and novel that they are displaying some of it in the same museums—including London's Tate Gallery and the San Francisco Museum of Modern Art—as Cohen's abstract art. In "a museum, it's important to show things of lasting quality," such as Aaron's work, says Gwen Bell, founding president and director of Boston's Computer Museum. "Aaron has developed from early images that look like cave drawings to much more sophisticated drawings, and now paintings," she says. "Cohen's work with Aaron is truly art."

It is also work that a far wider audience has enthusiastically received than the one that acclaimed the abstract art Cohen used to create—proof that he is accomplishing his goal of intriguing the general public with artwork. ■

N



■ COMPUTER-DRAWN AND HAND-PAINTED IMAGES FROM 1991 AND 1992 (*L,M*) CAPTURE DISTINCTIVE FEATURES OF PLANTS AND FACES. COHEN'S DEVICE (*N*) PAINTS A PICTURE EARLIER THIS YEAR.

TO VIEW THIS ARTICLE WITH INTERACTIVE LINKS, VISIT OUR WORLD WIDE WEB SERVER AT
< HTTP://WEB.MIT.EDU/TECHREVIEW/WWW/ >

Rekindling the Flame

It may seem quixotic, in this season of government downsizing and budget cuts, to create a new federal department. But momentum is building for a new Department of Science and Technology, which would be responsible for a set of scientific and technological agencies now dispersed in the government. This department could have powerful clout in Washington. Its budget, depending on the agencies assembled, would range from $25–40 billion. It would permit much improved strategic planning and conduct of the federal science and technology enterprise and allow trade-offs among programs not possible in the present structure.

Such a department has been proposed repeatedly for decades (the first time was in 1884), and each time has been soundly rejected. But advocates have now moved into positions of influence. The chair of President Clinton's Committee of Advisors on Science and Technology is John Young; in 1985, Young chaired President Reagan's Commission on Industrial Competitiveness, which recommended a Department of Science and Technology. Recently, Speaker Newt Gingrich and Rep. Robert Walker (R-Pa.)—chair of the House Science Committee and vice-chair of the House Budget Committee—told a gathering of Washington science writers that they intend to present legislation to establish such a department. Senate Majority Leader Robert Dole has advocated abolishing four cabinet departments, including some that oversee major scientific and technological activities—a move that could dovetail neatly with the establishment of a Department of Science and Technology.

Resistance can be expected from many quarters. The academic-research community will probably oppose any move that reduces the independence of the National Science Foundation (NSF) or that shifts the National Institutes of Health (NIH). The Department of Commerce can be expected to try to thwart a move of the National Oceanic and Atmospheric Administration to the new department, because NOAA comprises about half of Commerce's budget and more than half its staff. Objections will also arise from the congressional committees that would lose jurisdiction over agencies and functions they now control.

A federal department is also anathema to many in the science and technology community, because they perceive the possibility of a monolithic institution that would threaten the dispersed federal marketplace for research support—an arrangement viewed as essential to supporting diverse approaches to R&D. And there is the danger that an ill-conceived new department would strip existing agencies of the R&D capabilities needed to advance their missions.

But the present organization is hardly ideal; many science and technology agencies now operate under the umbrella of a department whose principal functions are unrelated to their own. As a result, the science and technology communities lack the strong voice of a cabinet member with line responsibilities. NOAA, which is lodged in the Department of Commerce by historical accident, is one good example. Another is the NIH, which funds and conducts the preponderance of federally funded biomedical research yet sits several echelons down in the huge Department of Health and Human Services. And while independent agencies such as NSF and the National Aeronautics and Space Administration do not suffer the filter of department-level budget scrutiny, their complete lack of cabinet-level leadership nevertheless diminishes their policymaking influence.

A Department of Science and Technology might incorporate some set of agencies from among NASA, NSF, NOAA, NIH, the U.S. Geological Survey (USGS), and the national labs of the Department of Energy (DOE). Bringing these agencies together under common management would encourage more effective collaborations than are now possible. Common interests among agencies abound. NASA, NOAA, and the USGS, for example, all have on their agenda the use of space technology for earth and environmental observation. NSF shares an interest in astronomy with NASA and in fundamental physics with many of DOE's national laboratories.

The new department would not be all-inclusive; science and technology functions would continue in existing departments and agencies as necessary to advance their missions. Coordinating this work with that of the new department would be one job of the president's science and technology adviser.



While this consolidation would probably save some money overall, the rationale for forming the department should not be to cut costs but to increase the effectiveness of the national science and technology effort. And with both the Republican Congress and Vice-President Gore pushing the theme of overhauling government, the possibility is growing that a flame will rise from the ashes of previous proposals for a Department of Science and Technology. ■

ROBERT M. WHITE is president of the National Academy of Engineering.

PHOTO: CLAUDE VAZQUEZ

Privileged Communications

By well-earned reputation, Americans are basically friendly, optimistic, eager to help those in need. But you'd never know it from the mounting waves of bile, bitterness, and rage on the nation's airwaves and computer networks. What is it about these channels that makes them such convenient vehicles for public anger?

Leading the chorus is AM talk radio, a medium that these days has distinguished itself as a toxic waste dump for amorphous scorn and resentment. Bullying hosts goad callers to vent as much venom as possible, especially if the anger is directed at welfare recipients, environmentalists, government spending, taxes, and liberal politicians. One New York City talk host rails against the "mutants" that haunt the streets, leaving no doubt as to the race of these supposed miscreants. This is what passes for entertainment on radio stations that over the years watched once-large audiences for music move on to the cleaner, clearer sound of FM. Ingenious AM station managers eventually found they could boost ratings by peddling shock, sensationalism, and sheer gall. Evidently, those still listening want their talk hot, even brutal.

Alas, a similar mean-spirited mood has now seeped into conversations on Internet newsgroups and other computer talk forums, where caustic chatter is now commonplace. At its worst this shows up as "flaming," in which self-appointed thugs heap nasty, sometimes obscene messages on people who have offended them. "I am presently pro-life," announced a contributor to "alt.politics.elections" recently, "but I would consider changing my position if the pro-choice people would agree to be aborted retroactively." Juvenile invective of this kind flows heaviest in groups focusing on controversial political issues. But it also crops up in seemingly innocuous settings; a recent discussion thread on an Internet parenting newsgroup, "misc.kids," featured continuing diatribes against welfare mothers.

In both its radio and cyberspace versions, hyperventilating trash talk flourishes where there is freedom but no accountability. In other settings for free speech—in public meetings or letters to the editor of one's local newspaper—one has to weigh the likely response of one's neighbors. These constraints have vanished. Anonymous talk-show callers and aggressive netsurfers hurling barbs at long distance can be as outrageous, uncaring, and ill-informed as they please. Attempts to correct their errors and insults are lost in the flow of intemperate verbiage.

This crudeness is the price we pay for our First Amendment liberties, rights I would never give up. But it is worth noting that some segments of society benefit more than others from the barrage of social scorn and fury. A close listening to the talk shows reveals a skewed demography: callers tend to be wealthy and upper-middle-class folks (many seem to call from car phones), who have free time with which to dump on policies that benefit the poor, disabled, and elderly.



Computer chat has a steeper price of admission, and, judging from my 15 years of sampling computer teleconferences and newsgroups, the medium is even more thoroughly dominated by the comfortable classes. Here the long-expected gap between the information-rich and the information-poor begins to have real bite. People equipped with personal computers, modems, cellular phones, and the like have begun to outshout those in our society for whom owning a telephone may conflict with paying the rent or doctor.

There may be method in this madness as well. Media consultants to political campaigns have long recognized the value of negativism. It is not merely that a candidate or group finds advantage in attacking the opponent; politics has always been a knock-down, drag-out affair. But during the past 20 years image shapers have identified an added benefit from rancorous rhetoric. As disgust with public affairs rises, voter participation falls—turnout in the 1994 elections was a paltry 38 percent. The quickest to be alienated by this ugly discourse are poor and working-class people, who stay home disproportionately on election day and whose citizenship is reduced to cynical grumbling about how "the system doesn't care about people like me." Their abstention cedes electoral power to the more well-off—who, in voting for their own interests, tend to move the nation rightward. It is no coincidence that Roger Ailes, who orchestrated the Republican move to the right, is executive producer of Rush Limbaugh's nightly TV show.

Seen in this light, the harsh speech on our electronic channels seems less a fad than a strategy. Those "empowered" by it can no doubt celebrate their wealth and growing influence. But they leave in their wake a disgruntled polity whose systems of "communication" are more and more unhinged. ■

LANGDON WINNER, author of The Whale and the Reactor, *teaches science and technology studies at Rensselaer Polytechnic Institute. His e-mail address is winner@rpi.edu.*

PHOTO: L. BARRY HETHERINGTON

TECHNOLOGY UPDATE

900 MHz breakthrough!

New technology launches wireless speaker revolution...

Recoton develops breakthrough technology which transmits stereo sound through walls, ceilings and floors up to 150 feet.



Breakthrough wireless speaker design blankets your home with music.

by Charles Anton



If you had to name just one new product "the most innovative of the year," what would you choose? Well, at the recent *International Consumer Electronics Show*, critics gave Recoton's new wireless stereo speaker system the *Design and Engineering Award* for being the "most innovative and outstanding new product."

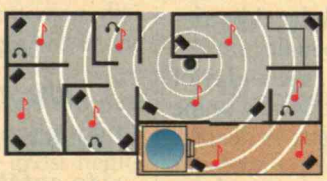
Recoton was able to introduce this whole new generation of powerful wireless speakers due to the advent of 900 MHz technology. This newly approved breakthrough enables Recoton's wireless speakers to rival the sound of expensive wired speakers.

Recently approved technology. In June of 1989, the *Federal Communications Commission* allocated a band of radio frequencies stretching from 902 to 928 MHz for wireless, in-home product applications. Recoton, one of the world's leading wireless speaker manufacturers, took advantage of the FCC ruling by creating and introducing a new speaker system that utilizes the recently approved frequency band to transmit clearer, stronger stereo signals throughout your home.

150 foot range through walls!

Recoton gives you the freedom to listen to music wherever you want. Your music is no longer limited to the room your stereo is in. With the wireless headphones you can listen to your TV, stereo or CD player while you move freely between rooms, exercise or do other activities. And unlike infrared headphones, you don't have to be in a line-of-sight with the transmitter, giving you a full 150 foot range.

The headphones and speakers have their own built-in receiver, so no wires are needed between you and your stereo. One transmitter operates an unlimited number of speakers and headphones.



Recoton's transmitter sends music through walls to wireless speakers over a 70,000 square foot area.

Crystal-clear sound anywhere. Just imagine listening to your stereo, TV, VCR or CD player in any room of your home—without running miles of speaker wire. Plus, you'll never have to worry about range because the new 900 MHz technology allows stereo signals to travel distances of up to 150 feet through walls, ceilings and floors without losing sound quality.

A single transmitter, unlimited receivers. The powerful transmitter plugs into an audio-out, tape-out or headphone jack on your stereo or TV component, transmitting wirelessly to speakers or headphones. The speakers plug into an outlet. One transmitter broadcasts to an unlimited number of stereo speakers and headphones. And since each speaker contains its own built-in receiver/amplifier, there are no wires running from the stereo to the speakers.

Full dynamic range. The speaker, mounted in a bookshelf-sized acoustically constructed cabinet, provides a two-way bass reflex design for individual bass boost control. Full dynamic range is achieved by the use of a 2" tweeter and 4" woofer. Plus, automatic digital lock-in tuning guarantees optimum reception and eliminates drift. The new technology provides static-free sound in virtually any environment. The speakers are also self-amplified; they can't be blown out no matter what your stereo's wattage.

Stereo or hi-fi, you decide. These speakers have the option of either stereo or hi-fi sound. Use two speakers (one set on right channel and the other on left) for full stereo separation. Or, if you just want to add an extra speaker to a room, set it on mono and listen to both channels on one speaker. Mono combines both left and right channels for hi-fi sound. This option lets you put a pair of speakers in the den and get full stereo separation or put one speaker in the kitchen for hi-fi sound.

Factory-direct savings. Our factory-direct pricing allows us to sell more wireless speakers than anyone! For this reason, you can get these speakers far below retail with our 90-day risk-free home trial."



Add headphones and save $100. For a limited time, when you order two speakers and a transmitter, you can add wireless headphones for only $49. That's a savings of $100 off the price of the headphone system. This exclusive offer is available only through Comtrad. Your order will be processed within 72 hours and shipped UPS.

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FRANÇOIS J. CASTAING

How to Stifle Innovation



IT'S becoming a familiar story: a person suffers a horrible personal tragedy using a product, and successfully sues the product's manufacturer:

•A young couple drives a compact car into a horse that was wandering down the middle of the road. The horse's body smashes into the windshield, killing the woman. A jury rules the vehicle wasn't "crashworthy."

•A woman tries to commit suicide by locking herself in the trunk of her car. She changes her mind, but it takes nine days before someone finds her and lets her out. The woman claims the automaker was negligent in not providing a release inside its trunks; a jury agrees, and the verdict is upheld on appeal.

•A teenage boy who has been drinking takes his girlfriend out for a fast drive on a rainy night. The vehicle, on which he has installed much larger wheels than the chassis and suspension were designed to accommodate, crashes off the side of the road. The girl, who is not wearing a seatbelt, is ejected and suffers permanent damage to her spine. Her family successfully sues the carmaker, claiming that a design defect caused the accident.

In each of the above incidents or accidents, the vehicles met federal safety standards at the time of their design and manufacture and did not technically malfunction. Moreover, each incident involved circumstances far outside the normal operating range. Still, juries found that the vehicles were deficient in their design and awarded large cash settlements to the plaintiffs. It is in response to the proliferation of such cases that new laws to inhibit product liability litigation have recently passed the U.S. House of Representatives and await action in the Senate.

Curiously, the most important reason for enacting reform has received little attention. For while such legal battles inflict a high financial penalty on the U.S. automobile industry, the outlay of money to victorious plaintiffs may be the least insidious of the costs. A deeper, more long-term effect is that rampant litigation is stifling car companies' incentive to innovate.

In fact, the threat of liability creates a huge disincentive to honestly and critically evaluate the features on current and past vehicles. Because automakers are frequently called on to defend past product designs in the courtroom, engineers and designers fear that any document—be it a detailed proposal, a note in a day planner, or a sketch on a napkin—might be taken out of context and become evidence against the company. This has a chilling effect on the creative process.

Say, for example, that an automotive engineer thinks he or she can improve the performance of antilock brakes by enabling them to pulse 20 times a second instead of 5 times a second—and that such a system would be cheaper to manufacture. The proposal could become a nightmare if the company were to face a product liability suit, since the plaintiff's lawyer could claim that the engineer's innovative proposal "proves" that the company knew its old antilock braking system was "deficient."

Liability lawsuits are supposed to make companies more attentive to safety. But since courts use new designs as evidence of a prior defect, litigation can retard innovation.

Similarly, carmakers may be reluctant to implement new or improved designs in their vehicles *quickly*, even though the

ILLUSTRATION: RICHARD COOK

ability to make quick product changes can be a strong competitive advantage. Here too the same backward logic is at work: manufacturers fear someone might contend that they knew from the start that a vehicle or component was deficient. Yet with product development cycles in the auto industry now as short as 30 months, engineers need to be looking at how they will improve the next generation of vehicles as soon as they complete the current models.

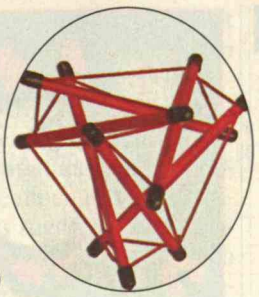
Some critics of the auto industry contend that high settlements in product liability suits force carmakers to manufacture better and safer vehicles. But the data do not support this notion that "lawsuits are the mother of invention." I am a native of France and I spent the early part of my engineering career in Europe; I have seen how effectively engineers can work without the ever–present fear of litigation. After all, lawsuits are comparatively rare in Europe and almost unheard of in Japan, but companies like Volvo have long enjoyed reputations for being at the forefront of safety technology. That's because European and Japanese engineers need not fear that the brainstorming work of proposing, discussing, trying, or testing ideas will haunt them in a future lawsuit.

Product liability laws are supposed to compensate people for injury, promote safety, and penalize gross negligence. If a corporation is irresponsible, it should be held accountable. U.S. courts no longer seem to adhere to this standard. Reforms to the legal system, if they are enacted, might dampen the incentive to file frivolous suits. But there is no guarantee that the pending new rules would stop juries from meting out punishment for risks that cannot be avoided when a product is sold to a public that has wide discretion in how it chooses to use it. That's no way to innovate—or compete. ■

FRANÇOIS J. CASTAING is vice-president for vehicle engineering at Chrysler Corp. This article is adapted from Product Liability and Innovation: Managing Risk in an Uncertain Environment *(National Academy Press, 1994).*

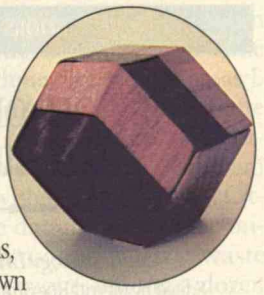
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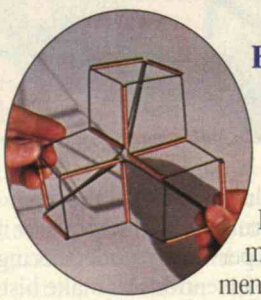


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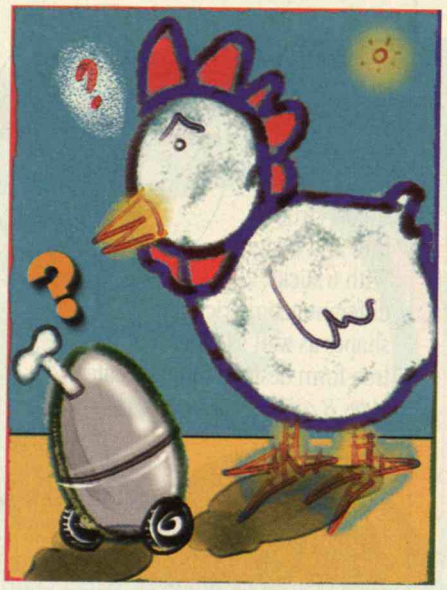
Reviews

BOOKS

THE ROLE OF A NEW MACHINE

Does Technology Drive History?
Edited by Merritt Roe Smith and Leo Marx
MIT Press, $16.95 in paper

BY G. PASCAL ZACHARY



THE parade of "new and improved" products is so rapid today that those who track technological change are usually too busy sorting through them to confront larger questions about the relationship between technology and culture. Yet much of what provokes anxiety about technological change is precisely the inability, or perhaps the unwillingness, of sponsors, inventors, promoters, and consumers to confront those questions. None is more important, none causes more worry or even fear, than the view that machines make history, that our tools and technologies determine the nature of our society.

This view, termed "technological determinism," has long seduced both academics and the public. In the introduction to a new collection of essays entitled *Does Technology Drive History?*, Merritt Roe Smith, a historian at MIT, locates the source of technological determinism in "the early stages of the Industrial Revolution," when, ironically, the notion inspired not fear but hope. Supported by relentlessly upbeat advertising, "technology became idolized as the force that could fix the economy and deliver on the legendary promise of American life," he writes. Advertisers pitched their products not simply as fixes for specific needs but as a means to health and happiness. By the early twentieth century, "technology had . . . become the *cause* of human well-being," Smith observes. Technological determinism took even deeper root by mid-century, with weapons of mass destruction perversely underscoring the capacity for inventions to make history.

However, the 1960s proved to be a watershed for technological determinists, Leo Marx, a professor of history at MIT, finds in his essay. For many people, the Vietnam War, and the later miscalculations that produced acid rain, Chernobyl, Bhopal, and the possibility of global warming, have led to the conclusion that technology per se does not drive history after all. Rather, the driving force is seen to be the decisions people make about how to use technology. There has been a growing realization that "high technical skills may serve to mask . . . the choice of ends," Marx writes. Though technological determinism has hardly faded away, this other way of thinking has begun to gain ascendency. Both academics and citizen-activists have urged closer scrutiny of technical choices and a consideration of the ways in which powerful sponsors can influence specific innovations.

For help in explaining the social pressures acting upon technology, historians and sociologists have drawn on a theory called "social constructivism," which calls attention to a mountain of previously ignored evidence that shows how different cultures have reacted in vastly different ways to the same innovation. For example, why did farmers in the American Midwest embrace new seeds and cropping techniques earlier this century while Chinese farmers, when given the same opportunities, did not? Why did television spawn a cornucopia of commercially driven programming in the United States while in the Soviet Union the same medium served up drab, state-controlled shows? Such case studies amount to a convincing rebuttal of "hard" technological determinism, a stance epitomized by Karl Marx's famous maxim: "The hand mill gives you society with the feudal lord; the steam mill, society with the industrial capitalist."

Social constructivists have also illuminated the ways in which individuals create technologies that reflect their own biases and needs. Technologies as diverse as household appliances, missile-guidance systems, and computers have resulted from a myriad of social choices, with innovators facing open-ended turning points. The first digital computers, for instance, were greatly shaped by the pressures of World War II, when the military needed to perform more quickly the voluminous calculations entailed in charting bomb trajectories. Absent these pressures, engineers might have stressed from the start the computer's awesome ability to produce images on a TV screen. Each path was open, but because of human choices, the number cruncher took precedence over the image maker.

In *Does Technology Drive History?*, the social constructivist perspective is taken for granted. Indeed, most of the contributors are unabashedly impatient with the still-popular notion that tools, as opposed to styles of mind, define a civilization. Peter Perdue, a professor of history at MIT, demolishes the influential argument historian Lynn White makes in his 1962 classic book *Medieval Technology and Social Change*—that the heavy plough led to the rise of northern Europe's manorial economy, in which land was consolidated into large

ILLUSTRATIONS: SUSAN LEVAN

plots and ploughing coordinated by a central council. Perdue notes that even though this plough was available to farmers in Italy and southern France, it had no such effect there. The farmers found other means of raising output, eschewing the technology.

But if the evidence against it is so clear-cut, why does the notion that machines make history retain its appeal? In his essay, Michael L. Smith, a historian at the University of California at Davis, is perplexed by the "stubborn tenacity" of most Americans who cling to this view. "How can something so demonstrably wrong-headed continue to sway adherents?" he asks.

Glossing Over Social Divisions

The answer is provided by the few dissenting views in this volume. Thomas Hughes, professor of history at the University of Pennsylvania and author of the masterful *American Genesis*, which recounts this nation's technological enthusiasm over the hundred years starting in 1870, offers a compelling explanation for the belief that at least some technologies have a life of their own. In his essay, Hughes distances himself from social constructivism by arguing that the technologies at the heart of complex systems "tend to be more shaping of society and less shaped by it" over time. Examples include the telephone, the automobile, and electricity. Younger technologies, he insists, are more susceptible to social, cultural, and political influences, while mature technologies grow increasingly rigid as they gain "momentum."

Hughes's view seems to fit the facts. "Momentum" explains why there is a frantic race to shape the infant information highway. The concept also explains why even after the end of the Cold War there is great resistance to dismantling such mature technological systems as the nation's nuclear weapons complex. And the repeated failure to revive mass transit makes a great deal of sense when one considers the extent to which the country is dominated by "car culture."

The book's contributors don't let Hughes carry the day, however. Philip Scranton, a historian at Rutgers University, criticizes the "momentum" explanation as too general, arguing that the circumstances surrounding most technological changes are much more idiosyncratic than Hughes suggests. But Scranton seems unaware that in paying such scrupulous attention to those idiosyncracies and trying so hard to establish the social basis for specific innovations, he and like-minded scholars have glossed over social divisions—differences in class, race, culture, and sex. These often render many people powerless to shape an emerging technology. In fact, some of the most contentious technologies of this century were not subject to widespread public debate at their outset. The history of nuclear power well illustrates the tendency of politically insulated experts to impose longlasting technological "solutions" on the public. Similarly, only a tiny elite chose the design of weapons systems or cancer-fighting tactics that the entire society now has to live with.

Yet social constructivists hardly lack a social conscience. While the scholars represented in *Does Technology Drive History?* are intent on describing the dynamics of the past, they also keep an eye on the here and now. For instance, they openly worry that their conclusions may unduly comfort the rich and powerful patrons of new technologies. As John Staudenmaier, professor of history at the University of Detroit Mercy and editor of *Technology and Culture*, points out, the commercial importance of "an upbeat image for current technologies" ensures that dour assessments of past technologies will be "hotly contested," and the social constructivist argument that no technology is in and of itself harmful to society could easily be enlisted to support that upbeat image.

Ordinary people, of course, must grapple with the less academic task of discerning both the practical potential and the limits of technological innovations. Since the very content of their lives is at issue, a detached preoccupation with how a particular innovation came to be is the last thing they feel. Thomas J. Misa, a historian at the Illinois Institute of Technology, acknowledges that current scholarship does little to help them come to terms with their situation: "Citizens facing the daunting socio-technical problems of too much toxic waste and not enough ozone, among a dozen other challenges, may not appreciate [social constructivist] accounts that point to the harmony of technology and culture," he writes in this volume. It is precisely the failure to more fully examine the conflicts spawned by technology that tarnishes the achievement of these learned writers. ■

G. PASCAL ZACHARY is a reporter at the Wall Street Journal *and author of* Showstopper: The Breakneck Race to Create Windows NT and the Next Generation at Microsoft *(The Free Press, 1994). He writes frequently on technology.*

BOOKS

CURVEBALL

The Bell Curve
by Charles Murray and Richard Herrnstein
The Free Press, $30.00

BY ELLEN RUPPEL SHELL

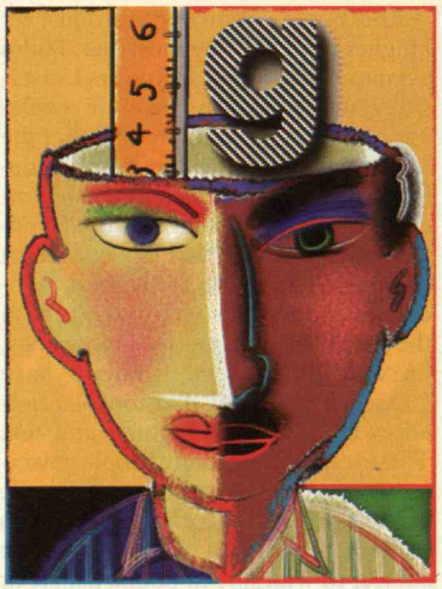
THE overnight sensation *The Bell Curve*, cowritten by social scientist Charles Murray and the late Harvard psychologist Richard Herrnstein, has provoked the venting of enough spleen to send sales of blood-pressure medication through the roof. It has been the talk of dinner parties, the subject of seminars, and the toast of publishing titans, most of whom count their successes not in scholarly awards but in dollars, like everyone else. The

success of *The Bell Curve* was such that to live "comfortably" (as my mother would say), Murray need never put pen to paper again, and for that, I suppose, we should be grateful.

Unfortunately, we journalists still have to scratch for our suppers, so my guess is that commentary on the book will, like the bunny in that annoying battery commercial, keep going and going and going. The question is, why? Why was *The Bell Curve* given full, front-page exposure in the *New York Times Book Review*? Why did it command cover-story status in news magazines and generous portions of air time on talk shows? Why was *The Bell Curve* a story?

The answer is certainly not to be found in that tiresome journalistic bromide, that Murray's ideas are "news." *The Bell Curve* is not news but a rehashing of an old, worn-out discussion of the link between genetics and intelligence. It argues that intellectuals and policymakers, their hearts bleeding into their brains, have underestimated the role of intelligence in determining life success. It contends that the poor are poor not because they are unlucky, deprived, or discriminated against but, darn it, because they are dumb. It suggests that rather than trying to educate these dullards to the standards required by what Newt Gingrich calls our "third-wave information age," society should provide them with menial tasks suited to their limited talents. And according to *Bell Curve* calculations, African Americans, on average, are dumber than other Americans and therefore as a group must regretfully be relegated to the bottom of the heap, where, well fed and much appreciated for performing the tasks they were born to, they will be happier and far less trouble.

These views the authors duly anoint with statistics. By converting ideology into charts and graphs, they claim to have purged it of subjectivity, to have scrubbed off the moldy agenda they say their critics conceal like derringers in their boots. But in fact they commit the cardinal sin of statistical analysis—they



set out to prove, not disprove, their hypothesis. And in so doing they take so many gleeful leaps of logic that cascading through their arguments is like slipping down Alice's rabbit hole into a world that is at once plausible and surreal.

One small example is the manner in which they "prove" that low intelligence—not low motivation, as some argue—is the reason blacks do less well than whites on standardized tests. The authors begin by asserting that "smarter people process faster than less smart people." One could easily quibble with that, but for the sake of argument, I won't. They then describe a test in which subjects are asked to put their finger on a button in the middle of a circle of dimmed lights, and to dart their finger as quickly as possible to a button near any light in the circle that is suddenly turned on. Blacks, on average, are at first slower to react to the light, but move more quickly to extinguish it once they do react.

The slight hesitation followed by the rapid hand movement, the authors say, indicates both the black subjects' clear motivation to perform the task (why do they move quickly if they don't care?) and their lower intelligence (if they were smart, they would react more quickly in the first place). But to accept this interpretation, one must *assume* that blacks were trying their hardest—we must discount, for example, that they might have reacted or moved their hands even faster if they really cared about the silly test. The authors also ignore the very real possibility that blacks and whites have a different reaction style—that blacks may hesitate a split second to make sure of their choice, knowing they can move rapidly to douse the light once they are convinced it is lit. Both interpretations have been suggested by other commentators on this particular test. However, not by Herrnstein and Murray. This trick of putting a complex question before the reader and then presenting a possible solution as though it were the definitive one is typical of *The Bell Curve*. Naturally, most of the "solutions" put forward are supportive of the book's underlying thesis.

The Pesky Journalistic Itch

By reducing ideology, the purview of the right-brained, to statistics, the domain of the left-brained, Murray succeeded in confusing many journalists and talk-show hosts long enough to get some serious notice before the ax fell. But this only partially explains *The Bell Curve*'s success. Perhaps more fundamental was the fact that the book claims to take a steely-eyed look at the "facts" about genetics and intelligence, a look that reveals some politically unpopular but terribly important truths. This is particularly appealing to journalists, who today are pressured to back down from what is perceived as their soft-hearted but muddle-minded liberal agenda. What surely would have been laughed off as racist blather a decade ago took on a shroud of authenticity in this brave new world of "hard truths"; whether we liked it or not, journalists were compelled to take *The Bell Curve* seriously.

This is not to say that we necessarily read its 552 pages of text, or pored over its 90-page appendices or 100 pages of "notes"—who had time for that? No, we put the book on our desks and stared

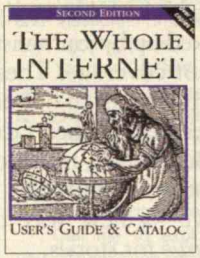
at it long enough to find a grain of truth on which to hang our "objective" response. In some cases, such as in the *Wall Street Journal*, *Newsweek*, and the *Boston Globe*, that response consisted of picking up on Murray's lament that his theory was wrongfully dismissed by serious scholars such as psychologists Howard Gardner of Harvard, Robert Sternberg of Yale, and Richard Nisbett of the University of Michigan not because it is unsupported but because it is politically incorrect. Some journalists went so far as to quote Murray, saying that clear-headed scientists agreed with his theories in private but would not speak out for fear of disturbing the equal-opportunity police.

"The science behind *The Bell Curve* is overwhelmingly mainstream," wrote Geoffrey Cowley in *Newsweek*. "In short, cognitive inequality is not a political preference. It's a simple fact of life." Cowley provided evidence of this in the form of a 1984 survey in which 53 percent of social scientists agreed that "the black-white gap involves genetic as well as environmental factors." But that finding indicates only that a modest majority of social scientists think genetics as well as environmental factors influence intelligence. *The Bell Curve*, by contrast, contends that genetics swamps environmental effects to such a degree that different ethnic groups must approach life with a whole different set of expectations.

If political correctness has anything to do with serious critiques of Murray's ideas, it is not a lot. Social scientists are not so sure that intelligence can be measured by any single test, or that it should be—and many are sure that it cannot and should not be measured this way. In any case, even psychometricians, psychologists who make their living quantifying intelligence and designing intelligence tests, would not agree that intelligence based on a single measure (what *The Bell Curve* calls "g") can prove one group's intellectual superiority over another. That is Murray's idea.

All this was made painfully clear by Gardner, Nisbett, and others in letters to the editor and opinion pieces in maga-

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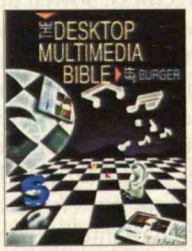
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zines and newspapers. And that analysis was dutifully picked up by journalists in a parallel wave of coverage. These reports, charging Murray as an opportunistic ideologue, seemed, on their face, more thoughtful. But in fact, much of the reporting was not thoughtful at all. It was simply reactive—a new way of milking *The Bell Curve* for stories.

The analysts who took a good, hard look at *The Bell Curve*'s arguments exposed them not as firebombs but as dried-up old chestnuts. These included paleontologist Stephen J. Gould in his essays in *Discover* and the *New Yorker*, historian Adolph Reed, Jr. in his review in the *Nation*, and sociologist Thomas Sowell in an article in the *American Spectator*, a journal noted for, if anything, political incorrectness. Sowell dismissed *The Bell Curve*'s rather curvy logic by pointing out that "groups outside the cultural mainstream of contemporary Western society tend to do their worst on abstract questions, whatever their race might be." (Mastering abstractions is, according to *The Bell Curve*, the sine qua non of intelligence.) Gould, Reed, and Sowell addressed *The Bell Curve* on its merits, not only on what they perceived as its authors' political agenda, and all found it sorely lacking.

Had journalists been equally judicious—less reactive, less eager to make as well as report the news—perhaps the tempest would have remained in its teapot. Instead, at this writing, the book sits cuddled in its niche on the *New York Times* bestseller list, wedged between an exposé on the secret life of cats and Barbara Bush's memoir. Murray, like Tiny Tim, is a creature of the media, and as such is entitled to his 15 minutes of fame. Let's just hope we have the good sense not to give him any more than that, because *Bell Curve: The Movie* might be too much for any of us to bear.■

ELLEN RUPPEL SHELL, codirector of the Graduate Program in Science Journalism at Boston University, is a widely published science writer.

CONTINUED FROM PAGE 9

WHOM IS NOT A FOUR-LETTER WORD

Your defense of "Who's Threatening Who?"(*TR November/December 1994*) states that you avoid whom "when it seems pretentious." If we cannot rely on MIT to be pretentious ("making claims, explicit or implicit, to some distinction, importance, dignity or excellence," according to Webster's New World Dictionary, Third College Edition), to whom shall we turn?

MR. AND MRS. DONALD E. BURKE
St. Petersburg, Fla.

THE THRILL OF A TURBINE

I was pleased to learn from "Turbine Cars" (*TR February/March 1995*) that David Gordon Wilson is a fellow believer in turbine power. In the summer of 1965 when I was 16 years old, my father became a test driver in Chrysler's turbine car program. What a treat for a teenager who was also a car nut! After accumulating more than 14,000 miles



in the three months we were allowed to drive the car, we were totally sold on the turbine engine. Although our enthusiasm was partially due to the packaging, the engine had great potential no matter which car Chrysler placed it in.

Because of the lack of any vibration, open road travel was pure pleasure. A trip across Montana, Wyoming, and Colorado posed no difficulties and averaged 15 miles per gallon overall (the car was heavy, the engine was small, and Chrysler did not tune the car for mileage).

The only negative aspect of the turbine was the slight time lag before movement started after we stepped on the accelerator. To overcome this, we practiced a drag racer's trick of torque loading, which entailed holding the

left foot firmly on the brake while hitting the accelerator pedal with the right foot. This turned out to be quite a crowd pleaser as it "smoked the tires a bit." Chrysler eliminated the lag completely on its subsequent turbine engines.

My father died wondering why Chrysler never did more with the turbine engine. I, too, am mystified why my children and I are still using automobile technology that should have been abandoned long ago. Silent, sterile electric cars will never match the thrill of a turbine car.

MARK E. OLSON
Proctor, Minn.

OUR PLANET, OURSELVES

Thank goodness there is an educational movement among physicians who understand the connection between environmental and human health, as Eric Chivian points out in "The Ultimate Preventive Medicine" (*TR November/December 1994*).

As a wilderness-area supervisor for the U.S. Forest Service, I work to ensure that natural processes occur with the least interference by humans, most of whom visit for recreational purposes. Wilderness areas serve a myriad of purposes, including purifying and storing water, supporting research, and educating visitors. Simply put, wilderness areas are places where natural processes continue so that all life may be sustained.

Humans are changing the earth's environment radically without knowing the point at which we will have irretrievably altered natural processes. But, as Chivian puts it, "Global environmental change is ultimately a matter of human health, which is totally dependent on the health of the environment." So, add one more significant non-recreational purpose to wilderness areas—ensuring our own human health by improving the understanding of our impact on the environment.

MICHAEL OLWYLER
Wilderness Area Supervisor
U.S. Forest Service
North Fork, Calif.

Classifieds

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Phenomena

By David Brittan

Bad Day on the World Wide Web

Your search request . . . ORIGIN OF THE PHRASE 'RUNCIBLE SPOON' . . . has produced 4 matching items:

1. Runcible Spoon Home Page (score .897); 2. Grant's Encyclopedia: Vols. 8, 9 (score .650); 3. Queensland Association of Emu Farmers (score .638); 4. National Flatware Historical Database, Bureau of Cutlery, U.S. Department of Commerce (score .436).

Runcible Spoon Home Page

I've wanted to start a 'zine about the **Runcible Spoon** ever since the lads burst onto the Saskatoon music scene last week. Now that I have my own Web page I can keep you up to date on the band's concert schedule and stuff. This is NOT an official publication of Saskatoon Technical High School.

- **Bio and photo of .Brad Campbell, lead guitar** (allow 10-30 minutes to download)
- **Discography** (there was supposed to be a sound clip here from the **Spoon**'s debut at Sleepy's, but somehow it just like totally disappeared)
- **Fellow Spoon fans who have Web pages**
- **Frequently Asked Questions**
- **My resume** (I will be entering university in the fall but need a summer job)

Other way-cool Web sites at STHS:

- **The Mighty Marching Bulldogs** • **Cafeteria** • **Key Club**

- **Do the lyrics to "The Jumblies" relate to something in Brad's life?**
- **Does Brad have a sig other?**
- **Where did the band get its name?**

A runcible spoon is one of those things that look like a cross between a spoon and a fork. Other than that, I don't know. You might try doing a Web search.

PREV. SCREEN PREV. SCREEN PREV. SCREEN

1. Runcible Spoon Home Page (score .897); 2. Grant's Encyclopedia: Vols. 8, 9 (score .650); 3. Queensland Association of Emu Farmers (score .638); 4. National Flatware Historical Database, Bureau of Cutlery, U.S. Department of Commerce (score .436).

Grant's Encyclopedia

Hi, I'm Grant. This is my encyclopedia.

Vol. 1: Abandonment to Bar mitzvah; **Vol. 2:** Child within to Double-crossing sister; **Vol. 3:** Early fears to Fair-weather friends; **Vol. 4:** Group therapy to Harassment by camp counselors; **Vol. 5:** Ingrates who doubted my genius to Jealous colleagues; **Vol. 6:** Kids who baited me at school to Lies, lies, and more lies; **Vol. 7:** Misery to Nausea; **Vol. 8: Origin** of my aversion to the **phrase** "them's the berries"; **Vol. 9:** Queasiness at the thought of being **spoon**-fed as a child to Rash on the roof of [illegible]; **Vol. 10:** Stains on my reputation [illegible]

PREV. SCREEN

1. Runcible Spoon Home Page (score .897); 2. Grant's Encyclopedia: Vols. 8, 9 (score .650); 3. Queensland Association of Emu Farmers (score .638); 4. National Flatware Historical Database, Bureau of Cutlery, U.S. Department of Commerce (score .436).

Queensland Association of Emu Farmers

G'day and welcome to the exciting world of emu production. As food processors worldwide learn that these large flightless birds are an excellent source of protein and can yield up to 5 liters of oil each, emu farming is becoming a growth industry throughout Australia. This Web page will show you how to set up your own emu farm so that you too can enjoy the fun and profitable occupation of ratite husbandry.

Emu, the Other White Meat

To start, you'll need a pair of emus and 1/8 to 1/4 acre of rangeland. Height requirements for fencing are from 5 to 6 feet. Build a long, narrow pen for exercising your emus, and be sure to install a state-of-the-art sound system, since certain kinds of music have been shown to increase reproductive rates and meat yields. The following sound clip has proved particularly effective:

The **Runcible Spoon**, Live at Sleepy's (allow 60-90 minutes to download).

We don't know where this clip came from, but the emus love it.

PREV. SCREEN

1. Runcible Spoon Home Page (score .897); 2. Grant's Encyclopedia: Vols. 8, 9 (score .650); 3. Queensland Association of Emu Farmers (score .638); 4. National Flatware Historical Database, Bureau of Cutlery, U.S. Department of Commerce (score .436).

National Flatware Historical Database

The mission of the Bureau of Cutlery is to strive for excellence in the preservation of America's tableware heritage. The bold spirit of Paul Revere lives on today among the nation's manufacturers of silverware, stainless-steel ware, hollow ware, and disposable flatware. We are proud to present this comprehensive database cataloguing the many important varieties of flatware, including their colorful history, current production statistics, and a glimpse into the future of this vital sector of the U.S. economy. Short video presentations feature professional actors in period costumes demonstrating the proper use of each utensil. Be sure also to visit the Bureau of Cutlery's new Virtual Museum of Utensil History, now featuring "The Endangered Butter Knife."

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

salad fork	spoon, dessert	spoon, silver
serving fork	spoon, gravy	spoon, serving
serving spoon	spoon, measuring	spoon, soup
spoon, basting	spoon, mixing	spoon, table
	spoon, runcible	spoon, tea

ERROR 404

Pursuant to the Data Reduction Act of 1995, the amount of data storage space available to the Bureau of Cutlery has been reduced from 965 gigabytes to 30 megabytes. Video demonstrations are now limited to utensils whose improper use could cause bodily injury, and all entries beginning with E, J, K, R, or S have been terminated. Please select another fine letter from our database. B perhaps.

The Data Reduction Act of 1995

Foreword by Rep. Sal A. Mander

For the last 40 years, centralized federal databases have been allowed to proliferate unchecked, while at the state and local levels, citizens have endured serious data shortages. With the passage of the Data Reduction Act of 1995, the American people hereby reclaim the data that are rightfully theirs.

This measure would not be necessary were it not for the current administration's profligate spending of the nation's precious data resources. Since taking office, the President and his federal Departments have behaved like the owl and the pussycat in the beloved 1871 nonsense poem of that name by British humorist Edward Lear: "They dined on mince, and slices of quince,Which they ate with a

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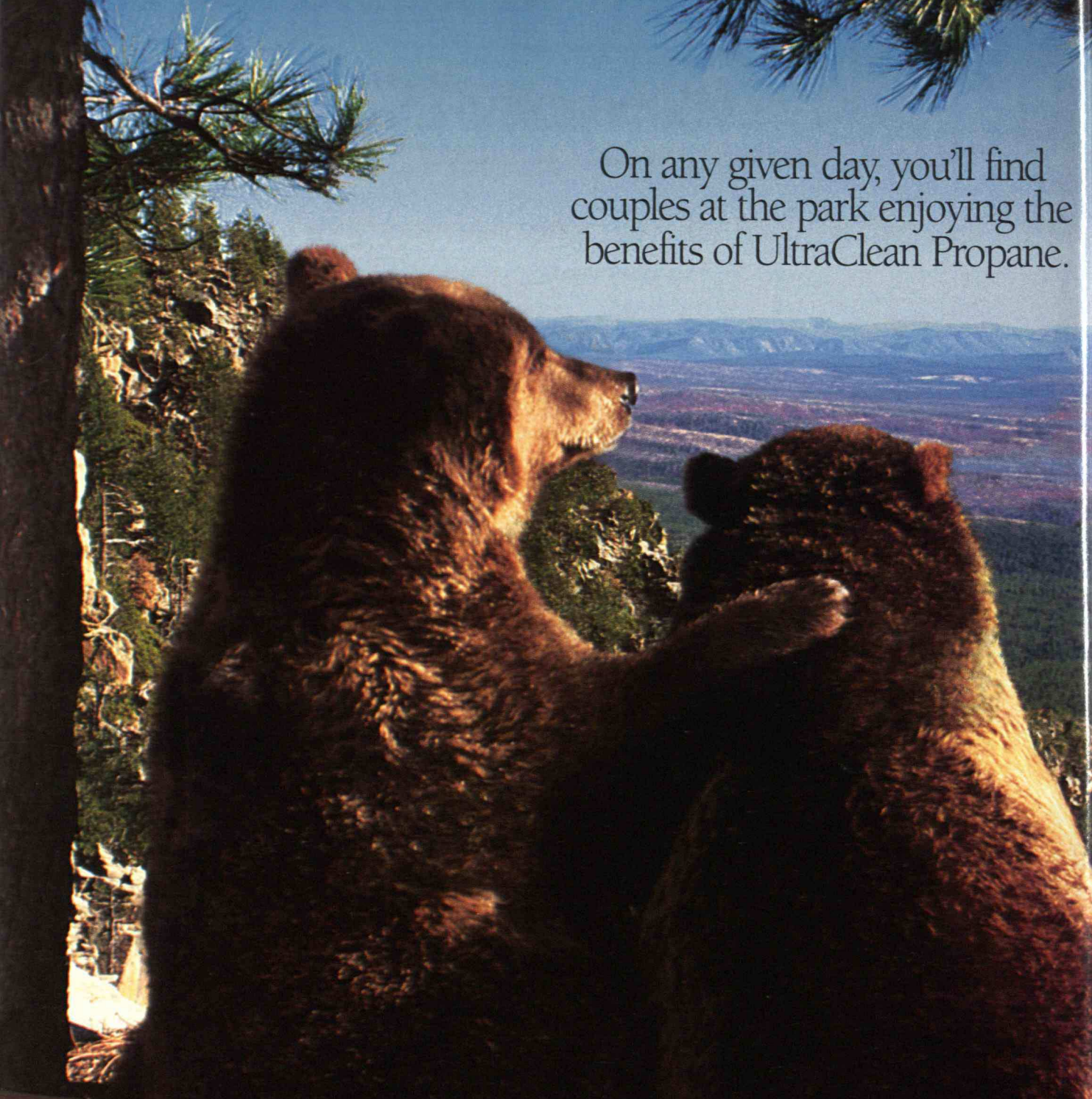
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